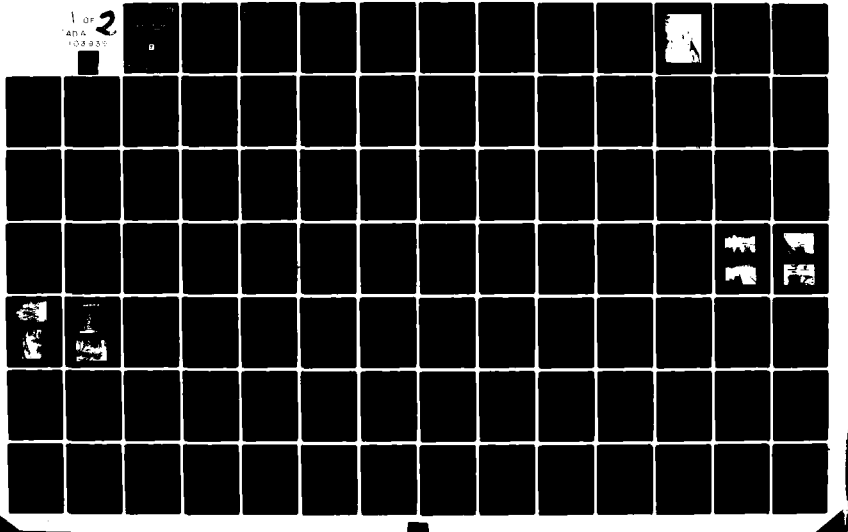
AD-A103 935 NEW JERSEY DEPT OF ENVIRONMENTAL PROTECTION TRENTON --ETC F/G 13/13
NATIONAL DAM SAFETY PROGRAM. MAPLE LAKE DAM (NJ 00776), PASSAIC--ETC(U)
JUL 81 W GUINAN DACW61-79-C-0011
UNCLASSIFIED DAEN/NAP-53842/NJ00776-81/ NL



PASSAIC RIVER BASIN
GOFFLE BROOK, BERGEN COUNTY
NEW JERSEY

MAPLE LAKE DAM
NJ 00776

PHASE 1 INSPECTION REPORT
NATIONAL DAM SAFETY PROGRAM

DEPARTMENT OF THE ARMY
Philadelphia District
Corps of Engineers
Philadelphia, Pennsylvania

JULY 1981

REPT. NO DAENINAP-53842/NJ00776-81/07

SECURITY CLASSIFICATION OF THIS PAGE (When Data Entered)

REPORT DOCUMENTATION PAGE

READ INSTRUCTIONS BEFORE COMPLETING FORM

1. REPORT NUMBER: DAEN/NAP-53842/NJ00776-81/07	2. GOVT ACCESSION NO.: AD-A103935
3. RECIPIENT'S CATALOG NUMBER:	
4. TITLE (and Subtitle): Phase I Inspection Report. National Dam Safety Program. Maple Lake Dam (NJ00776) Bergen County, New Jersey	5. TYPE OF REPORT & PERIOD COVERED: FINAL report
	6. PERFORMING ORG. REPORT NUMBER:
7. AUTHOR(s): Guinan, Warren, P.E.	8. CONTRACT OR GRANT NUMBER(s): DACW61-79-C-0011
9. PERFORMING ORGANIZATION NAME AND ADDRESS: Anderson-Nichols, 150 Causeway St., Boston, MA 02114	10. PROGRAM ELEMENT, PROJECT, TASK AREA & WORK UNIT NUMBERS:
11. CONTROLLING OFFICE NAME AND ADDRESS: NJ Department of Environmental Protection, Division of Water Resources, P.O. Box CN029, Trenton, NJ 08625	12. REPORT DATE: July 1981
	13. NUMBER OF PAGES: 50
14. MONITORING AGENCY NAME & ADDRESS (if different from Controlling Office): U.S. Army Engineer District, Philadelphia, Custom House, 2d & Chestnut Streets, Philadelphia, PA 19106	15. SECURITY CLASS. (of this report): Unclassified
	15a. DECLASSIFICATION/DOWNGRADING SCHEDULE:

16. DISTRIBUTION STATEMENT (of this Report)

Approved for public release; distribution unlimited.

17. DISTRIBUTION STATEMENT (of the abstract entered in Block 20, if different from Report)

18. SUPPLEMENTARY NOTES

Copies are obtainable from National Technical Information Service, Springfield, Virginia 22151.

19. KEY WORDS (Continue on reverse side if necessary and identify by block number)

Dams	National Dam Safety Program
Embankments	Maple Lake Dam, N.J.
Visual Inspection	Spillways
Structural Analysis	Erosion

20. ABSTRACT (Continue on reverse side if necessary and identify by block number)

This report cites results of a technical investigation as to the dam's adequacy. The inspection and evaluation of the dam is as prescribed by the National Dam Inspection Act, Public Law 92-367. The technical investigation includes visual inspection, review of available design and construction records, and preliminary structural and hydraulic and hydrologic calculations, as applicable. An assessment of the dam's general condition is included in the report.

DD FORM 1 JAN 73 1473 EDITION OF 1 NOV 65 IS OBSOLETE

SECURITY CLASSIFICATION OF THIS PAGE (When Data Entered)

DEPARTMENT OF THE ARMY
PHILADELPHIA DISTRICT, CORPS OF ENGINEERS
CUSTOM HOUSE - 2D & CHESTNUT STREETS
PHILADELPHIA, PENNSYLVANIA 19106

IN REPLY REFER TO

NAPEN-N

Honorable Brendan T. Byrne
Governor of New Jersey
Trenton, New Jersey 08621

31 AUG 1981

Dear Governor Byrne:

Inclosed is the Phase I Inspection Report for Maple Lake Dam in Bergen County, New Jersey which has been prepared under authorization of the Dam Inspection Act, Public Law 92-367. A brief assessment of the dam's condition is given in the front of the report.

Based on visual inspection, available records, calculations and past operational performance, Maple Lake Dam, a high hazard potential structure, is judged to be in poor overall condition. The dam's spillway is considered inadequate because a flow equivalent to 21 percent of the Spillway Design Flood - SDF - would cause the dam to be overtopped. (The SDF, in this instance, is one half of the Probable Maximum Flood.) The decision to consider the spillway "inadequate" instead of "seriously inadequate" is based on the determination that dam failure resulting from overtopping would not significantly increase the hazard to loss of life downstream from the dam from that which would exist just before overtopping failure. To ensure adequacy of the structure, the following actions, as a minimum are recommended:

a. The spillway's adequacy should be determined by a qualified professional consultant engaged by the owner using more sophisticated methods, procedures, and studies within six months from the date of approval of this report. Within three months of the consultant's findings, remedial measures to ensure spillway adequacy should be initiated.

b. Within 30 days from the date of approval of this report the owner should engage a qualified professional consultant to design and oversee procedures for the removal of trees, vines, and brush from the upstream and downstream slopes and for a distance of 25 feet from the downstream toe of the dam or limits of property, whichever is less.

c. Within six months from the date of approval of this report the owner should engage a qualified professional consultant to perform the following:

(1) Design and oversee repairs for the eroded areas on the downstream slope adjacent to the spillway, along the toe, and at the footpaths near the steel grating stairway.

(2) Design necessary remedial measures to prevent erosion of the toe by water flowing in the discharge channel downstream from the spillway.

(3) Design or specify repairs for the erosion of the upstream slope of the dam and design and specify erosion protection for the upstream slope of the dam.

(4) Investigate the cause of the wet, soft area 20 feet downstream from the toe of the dam near the left bank of the spillway channel.

(5) Design or specify reconstruction of the spillway and abutment walls.

(6) Design or specify repairs to the low level outlet.

(7) Design and oversee repairs to the cracked concrete core walls and upstream concrete walls.

d. Within three months from the date of approval of this report, the following remedial actions should be initiated:

(1) Start a program of checking the condition of the dam periodically and monitoring the wet area downstream from the toe of the downstream slope.

(2) Clear trees and brush from the discharge channel and from a zone 25 feet on either side of the discharge channel or to the property line, whichever is the lesser distance, from the spillway stilling basin to the next pond downstream.

(3) Control trespassing the dam.

(4) Start a program for maintaining the embankment free of weeds, brush, vines, and trees.

e. Within six months from the date of approval of this report the following remedial actions should be initiated:

(1) Backfill animal burrows with properly selected materials.

(2) Repair steel stairs on downstream face of dam.

f. The owner should develop written operating procedures and a periodic maintenance plan to ensure the safety of the dam, within one year from the date of approval of this report.

g. An emergency action plan and warning system should be developed which outlines actions to be taken by the owner to minimize the downstream effects of an emergency at the dam within six months from the date of approval of this report.

A copy of the report is being furnished to Mr. Dirk C. Hofman, New Jersey Department of Environmental Protection, the designated State Office contact for this program. Within five days of the date of this letter, a copy will also be sent to Congresswoman Roukema of the Seventh District. Under the provision of the Freedom of Information Act, the inspection report will be subject to release by this office, upon request, five days after the date of this letter.

Additional copies of this report may be obtained from the National Technical Information Services (NTIS), Springfield, Virginia 22161 at a reasonable cost. Please allow four to six weeks from the date of this letter for NTIS to have copies of the report available.

An important aspect of the Dam Inspection Program will be the implementation of the recommendations made as a result of the inspection. We accordingly request that we be advised of proposed actions taken by the State to implement our recommendations.

Sincerely,

Roger Baldwin

Incl
As stated

ROGER L. BALDWIN
Lieutenant Colonel, Corps of Engineers
Commander and District Engineer

Copies furnished:
Mr. Dirk C. Hofman, P.E., Deputy Director
Division of Water Resources
N.J. Dept. of Environmental Protection
P.O. Box CN029
Trenton, NJ 08625

Mr. John O'Dowd, Acting Chief
Bureau of Flood Plain Regulation
Division of Water Resources
N.J. Dept. of Environmental Protection
P.O. Box CN029
Trenton, NJ 08625

MAPLE LAKE DAM (NJ00776)

CORPS OF ENGINEERS ASSESSMENT OF GENERAL CONDITIONS

This dam was inspected on 23 April 1981, by Anderson-Nichols and Co. Inc., under contract to the State of New Jersey. The State, under agreement with the U.S. Army Engineer District, Philadelphia, had this inspection performed in accordance with the National Dam Inspection Act, Public Law 92-367.

Maple Lake Dam, a high hazard potential structure, is judged to be in poor overall condition. The dam's spillway is considered inadequate because a flow equivalent to 21 percent of the Spillway Design Flood - SDF - would cause the dam to be overtopped.. (The SDF, in this instance, is one half of the Probable Maximum Flood.) The decision to consider the spillway "inadequate" instead of "seriously inadequate" is based on the determination that dam failure resulting from overtopping would not significantly increase the hazard to loss of life downstream from the dam from that which would exist just before overtopping failure. To ensure adequacy of the structure, the following actions, as a minimum are recommended:

a. The spillway's adequacy should be determined by a qualified professional consultant engaged by the owner using more sophisticated methods, procedures, and studies within six months from the date of approval of this report. Within three months of the consultant's findings, remedial measures to ensure spillway adequacy should be initiated.

b. Within 30 days from the date of approval of this report the owner should engage a qualified professional consultant to design and oversee procedures for the removal of trees, vines, and brush from the upstream and downstream slopes and for a distance of 25 feet from the downstream toe of the dam or limits of property, whichever is less.

c. Within six months from the date of approval of this report the owner should engage a qualified professional consultant to perform the following:

(1) Design and oversee repairs for the eroded areas on the downstream slope adjacent to the spillway, along the toe, and at the footpaths near the steel grating stairway.

(2) Design necessary remedial measures to prevent erosion of the toe by water flowing in the discharge channel downstream from the spillway.

(3) Design or specify repairs for the erosion of the upstream slope of the dam and design and specify erosion protection for the upstream slope of the dam.

(4) Investigate the cause of the wet, soft area 20 feet downstream from the toe of the dam near the left bank of the spillway channel.

(5) Design or specify reconstruction of the spillway and abutment walls.

(6) Design or specify repairs to the low level outlet.

(7) Design and oversee repairs to the cracked concrete core walls and upstream concrete walls.

d. Within three months from the date of approval of this report, the following remedial actions should be initiated:

(1) Start a program of checking the condition of the dam periodically and monitoring the wet area downstream from the toe of the downstream slope.

(2) Clear trees and brush from the discharge channel and from a zone 25 feet on either side of the discharge channel or to the property line, whichever is the lesser distance, from the spillway stilling basin to the next pond downstream.

(3) Control trespassing the dam.

(4) Start a program for maintaining the embankment free of weeds, brush, vines, and trees.

e. Within six months from the date of approval of this report the following remedial actions should be initiated:

(1) Backfill animal burrows with properly selected materials.

(2) Repair steel stairs on downstream face of dam.

f. The owner should develop written operating procedures and a periodic maintenance plan to ensure the safety of the dam, within one year from the date of approval of this report.

g. An emergency action plan and warning system should be developed which outlines actions to be taken by the owner to minimize the downstream effects of an emergency at the dam within six months from the date of approval of this report.

APPROVED: Roger L. Baldwin

ROGER L. BALDWIN
Lieutenant Colonel, Corps of Engineers
Commander and District Engineer

DATE: 31 Aug 81

PHASE I INSPECTION REPORT
NATIONAL DAM SAFETY PROGRAM

Name of Dam:	Maple Lake
Identification No.:	Fed ID No. NJ00776
State Located:	New Jersey
County Located:	Bergen
Stream:	Goffle Brook
River Basin:	Passaic
Date of Inspection:	April 23, 1981

ASSESSMENT OF GENERAL CONDITIONS

Maple Lake Dam is an earthfill and concrete dam, possibly 80 years old but extensively rebuilt in 1947, that is in poor overall condition. It is small in size and should retain its high hazard classification. Trees, brush and vines are growing on the dam's earthen slopes making visual inspection difficult. Erosion has occurred on the upstream slope between the core wall and reservoir level. Erosion gullies varying in width up to 3 feet and ranging from 4 to 8 inches deep have developed at many locations on the downstream slope. Some animal burrows were found on the downstream slope. Several transverse hairline cracks were found in the concrete apron and 2-foot thick core-wall on the right side of the dam. Four transverse cracks, one badly spalled and eroded, were noted on the left side core-wall. Spalling and cracking of the spillway abutments was noted, and a major vertical crack about 2 inches deep was observed in the downstream face of the concrete spillway. The low-level pipe has several large boulders covering its outlet. The valve box for the pipe is submerged and does not appear to have been operated for a long time. Debris and boulders have accumulated in the stilling basin and discharge channel. The downstream channel has trees growing on the eroded banks. Another very low dam about 200 feet downstream ponds water up to the stilling basin intermittently. Only one area about 20 feet downstream of the toe to the left of the spillway channel was found to be wet and soft. The spillway will pass about 20 percent of the one-half Probable Maximum Flood and is considered inadequate.

We recommend that the owner retain the services of a professional engineer, qualified in the design and inspection of dams, to accomplish the following immediately: Design and oversee procedures for the removal of trees, vines, and brush from the upstream and downstream slopes and for a distance of 25 feet from the downstream toe of the dam or limits of property whichever is less; soon: design and oversee repairs for the eroded areas on the downstream slope adjacent to the spillways along the toe, and at the footpaths near the steel grating stair; design necessary remedial measures to prevent erosion of the toe by water flowing in the discharge channel downstream from the spillway; design or specify repairs for the erosion of the upstream slope of the dam and design and specify erosion protection for the upstream slope of the dam; investigate the cause of the

wet, soft area 20 feet downstream from the toe of the dam near the left bank of the spillway channel; design or specify reconstruction of the spillway and abutment walls; design or specify repairs to the low-level outlet; and design and oversee repairs to the cracked concrete corewalls and upstream concrete walls. In the near future: Perform a more detailed hydrologic/hydraulic evaluation of the inadequacy of the spillway and design and implement necessary remedial measures; and backfill animal burrows.

We also recommend that, as part of operating and maintenance procedures, the owner should accomplish the following in the time periods specified: Starting very soon: Begin a program of checking the condition of the dam periodically and monitoring the wet area downstream from the toe of the downstream slope; clear trees and brush from the discharge channel and from a zone 25 feet on either side of the discharge channel or to the property line, whichever is the lesser distance, from the spillway stilling basin to the next pond downstream; control trespassing on dam; and start a program for maintaining the embankment free of weeds, brush; vines, and trees. Starting soon: Develop an emergency action plan which outlines actions taken by the owner to minimize downstream effects of an emergency at the dam; and repair steel stairs on downstream face of dam. In the near future: Develop written operating procedures and a periodic maintenance plan to ensure the safety of the dam.

ANDERSON-NICHOLS & COMPANY, INC.

Warren A. Guinan

Warren A. Guinan, P.E.
Project Manager
New Jersey 16848

OVERVIEW PHOTO

CAPE FEAR DAM

February 17, 1981

PREFACE

This report is prepared under guidance contained in the Recommended Guidelines for Safety Inspection of Dams, for Phase I Investigations. Copies of these guidelines may be obtained from the Office of Chief of Engineers, Washington, D.C. 20314. The purpose of a Phase I Investigation is to identify expeditiously those dams which may pose hazards to human life or property. The assessment of the general condition of the dam is based upon available data and visual inspections. Detailed investigation, and analyses involving topographic mapping, subsurface investigations, testing, and detailed computational evaluations are beyond the scope of a Phase I investigation; however, the investigation is intended to identify any need for such studies.

In reviewing this report, it should be realized that the reported condition of the dam is based on observations of field conditions at the time of inspection along with data available to the inspection team. It is important to note that the condition of a dam depends on numerous and constantly changing internal and external conditions, and is evolutionary in nature. It would be incorrect to assume that the present condition of the dam will continue to represent the condition of the dam at some point in the future. Only through continued care and inspection can there be any chance that unsafe conditions be detected.

Phase I inspections are not intended to provide detailed hydrologic and hydraulic analyses. In accordance with the established Guidelines, the Spillway Test Flood is based on the estimated "Probable Maximum Flood" for the region (greatest reasonable possible storm runoff), or fractions thereof. The test flood provides a measure of relative spillway capacity and serves as an aid in determining the need for more detailed hydrologic and hydraulic studies, considering the size of the dam, its general condition and the downstream damage potential.

CONTENTS

PHASE I INSPECTION REPORT
MAPLE LAKE DAM SAFETY REPORT

MAPLE LAKE DAM FED ID NO. NJ00776

PHASE I INSPECTION REPORT
NATIONAL DAM SAFETY INSPECTION PROGRAM
MAPLE LAKE DAM
FED ID NO. #NJ00776

SECTION 1
PROJECT INFORMATION

1.1 General

a. Authority. Authority to perform the Phase I Safety Inspection of Maple Lake Dam was received from the State of New Jersey, Department of Environmental Protection, Division of Water Resources by letter dated 12 December 1980 under Basic Contract No. FPM-39 and Contract No. A01093 dated 10 October 1979. This Authority was given pursuant to the National Dam Inspection Act, Public Law 92-367 and by agreement between the State and the U.S. Army Engineers District, Philadelphia. The inspection discussed herein was performed by Anderson-Nichols & Company, Inc.

b. Purpose: The purpose of the Phase I Investigation is to develop an assessment of the general conditions with respect to the safety of Maple Lake Dam and appurtenances. Conclusions are based upon available data and visual inspection. The results of this study were used to determine any need for emergency measures and to conclude if additional studies, investigations, and analyses are necessary and warranted.

1.2 Project Description

a. Description of Dam and Appurtenances. Maple Lake Dam is an earth fill and concrete dam, with a hydraulic height of 13.9 feet, a structural height of 14.5 feet and a length of 290 feet. The dam has a concrete core wall that is visible the entire length of the dam. The dam crest is grass-covered and has an average width of 15 feet. On the right side of the dam, approximately 12.5 feet from the upstream face lies the center line of either a 3-foot wide concrete sidewalk or another concrete core wall which extends approximately 37 feet. The upstream side of the dam crest has, on both sides of the spillway, concrete platforms used for recreation. Beyond the concrete platforms on both the right and left of the upstream side are earthen embankments. The upstream face of the dam is vertical concrete. The downstream face is a 2H:1V sloped, earthen embankment. The concrete spillway is 48 feet long, located approximately 91 feet from the road on the right

overbank. The spillway crest is flat, 2.4 feet wide, with the upstream face vertical and the downstream face sloped 2H:3V. The stilling basin at the toe of the spillway is approximately 38 feet long, 20 feet wide, and has a 2-foot end wall with a 3-foot wide overflow weir. The low-level outlet, probably a 12-inch pipe, leads from a valve box at the left upstream end of the spillway, through the dam, and along the left end of the stilling basin. The pipe is encased in concrete downstream of the spillway.

b. Location. Maple Lake Dam is located on Goffle Brook in Wycoff Township, Bergen County, New Jersey. The dam is at 40° 59.9' north latitude 74° 09.6' west longitude on the Paterson Quadrangle. A location map has been included as Figure 2. It may be reached by driving on Newton Road northward from U.S. Route 202 to the railroad station in Wortendyke; the dam is about 100 yards west of the station just south of the railroad track.

c. Size Classification. Maple Lake Dam is classified as being small in size on the basis of storage at the dam crest of 57.5 acre-feet, which is less than 1000 acre-feet but more than 50 acre-feet, and on the basis of its structural height of 14.5 feet, which is less than 40 feet, in accordance with criteria given in the Recommended Guidelines for Safety Inspection of Dams.

d. Hazard Classification. Visual inspection of the area below Maple Lake Dam revealed a single house just upstream of Newton Road, approximately 1300 feet downstream of the dam. Analyses indicated that up to 1.5 feet of water could flood the first floor of the house. The house is of frame construction and would probably be destroyed, thus endangering the lives of the six occupants. Newton Road, at the same elevation as the first floor of the house, would also suffer some property damage from the 1.5 feet of water. For these reasons the dam is given a High Hazard classification.

e. Ownership. The dam is owned by the Canterbury Development Corporation. The corporate officers may be reached by writing to Mr. Morris Sarna, 2375 Hudson Terrace, Fort Lee, New Jersey 07024.

f. Purpose. Maple Lake Dam was rebuilt for recreational use. Its original purpose is not known.

g. Design and Construction History. Plan #419, dated March 27, 1947 of "Existing Conditions After Repairs and New Construction," done by Frank D. Livermore, Engineer, are on file at the New Jersey Department of Environmental Protection, Prospect Street, Trenton, New Jersey 08625.

h. Normal Operational Procedure. No operational procedures were found for the dam.

i. Site Geology. No site specific geologic information (such as borings) was available at the time the dam was inspected. Information derived from the Geologic Map of New Jersey (Kummel and Johnson, 1912) and the Glacial Drift of New Jersey (Salisbury, Kummel, Peet and Whitson, 1902) indicates soils within the immediate site consist of stratified drift which may be comprised of sand and gravel plains, deltas, eskers, kames, and terraces.

No bedrock outcrops were observed during the dam inspection. The previously mentioned geologic map indicates that bedrock in this area consists of soft red shale and sandstone of Triassic age.

1.3 Pertinent Data

a. Drainage Area

2.21 square miles

b. Discharge at Damsite (cfs)

Maximum flood at damsite - unknown.

Total ungated spillway capacity at maximum pool (top of dam) elevation - 771

c. Elevation (ft. above NGVD)

Top of dam -- 287.9

Maximum pool test flood surcharge - 289.3

Recreation pool (at time of inspection) - 285

Spillway crest - 285

Streambed at centerline of principal spillway - 274

Maximum tailwater (estimated) - 278

d. Reservoir (Length in feet)

Maximum pool - 800 (estimated)

Spillway crest - 700

e. Storage (acre-feet)

Spillway crest - 38.4

Top of dam - 57.5

Test flood - 75

f. Reservoir Surface (acres)

Top of dam - 9.6

Spillway crest - 6.4

g. Dam

Type - earthfill and concrete

Length - 290 feet

Height - 13.9 feet (hydraulic)

- 14.5 feet (structural)

Top width - 15 feet

Side slopes - upstream vertical, downstream 2H:1V

Zoning - unknown

Impervious core - concrete

Cutoff - unknown

Grout curtain - unknown

h. Spillway

Type - Broad crested, concrete

Length of weir - 48 feet

Crest elevation - 285 feet NGVD

Low level outlet - 12 inch pipe (estimated size)

U/S channel - Maple Lake

D/S channel - Goffle Brook

i. Regulating Outlets

Type - 1 foot x 2.5 foot concrete box encasing a 12-inch pipe

Length - 40 feet (estimated)

Access - valve box at upstream left end of spillway

SECTION 2
ENGINEERING DATA

2.1 Design

No hydraulic, hydrologic, or other design engineering data were disclosed. The design plans dated 1947 on file at NJDEP were in basic agreement with what was observed in the field. The dam plans from NJDEP did not show the low level outlet that was observed.

2.2 Construction

No recorded data concerning construction of the Maple Lake Dam were disclosed. The plans on file with NJDEP are plans detailing improvements made in 1947.

2.3 Operation

No data pertaining to the operation of the dam were found.

2.4 Evaluation

a. Availability. A search of the New Jersey Department of Environmental Protection files, and contact with community officials revealed a limited amount of information. All disclosed information with a copy of the plans was retrieved.

b. Adequacy. The plans, supplemented by visual inspection, are deemed adequate to complete this inspection.

SECTION 3
VISUAL INSPECTION

3.1 Findings

a. Dam. Trees are growing on the crest and upstream slope of the dam to the left of the spillway, on the downstream slope, and in the area at the downstream toe of the dam. The extensive vegetation on the downstream slope made it difficult to investigate the slopes thoroughly during the site visit.

The crest of the dam to the right of the spillway is comprised of a concrete apron, a 2-foot wide concrete core wall and zone of sandy soil which is partially covered with grass and vines. A 3-foot wide concrete wall was uncovered to the right of the spillway at the downstream edge of the crest which may be the top surface of another core wall. Several clusters of trees were growing near the waterline to the left of the upstream concrete apron on the left side of the dam. Erosion had occurred on the upstream slope between the core wall and reservoir level.

Erosion gullies varying in width up to 3 feet and 4 to 8 inches deep have developed at many locations on the downstream slope. Several paths are located near the steel grating stairway on the left side of the dam.

Several transverse hairline cracks were observed in the concrete apron and 2-foot thick core wall on right side. Four transverse cracks, one badly spalled and eroded, were visible on the concrete core wall, left of the spillway.

Large boulders up to 2 to 3 feet in diameter were incorporated into the lower half of slope to the right of the spillway wingwall. The boulders were partially obscured by the extensive vine growth on the slope. The area along the downstream toe exhibited no evidence of being wet and soft except for one area approximately 20 feet downstream from the toe near the left side of the spillway channel. A zone of erosion approximately 20 feet wide has occurred along the toe of the dam to the left of the spillway channel. Many boulders have been placed adjacent to the toe along this zone.

Some animal burrows and numerous small erosion gullies were observed on the downstream slope.

Another zone of small boulders was observed adjacent to the downstream toe in the vicinity of the left abutment.

b. Appurtenant Structures.

1. Ungated Spillway. The 48-foot wide concrete spillway near the center of the dam is badly spalled and eroded. One major vertical crack, up to 2 inches wide and approximately 2 inches deep, was observed on the downstream face. However, this crack shows no evidence of seepage. Both abutment walls to the spillway are badly eroded and undermined, where the abutments are in contact with the water. The right concrete spillway abutment wall has a vertical crack in the vicinity of the downstream edge of the crest, which is indicative of settlement or differential movement.

2. Gated Outlet. The downstream end of the low level outlet is badly spalled and covered with debris. The submerged valve chamber is visible on the upstream face but the valve size and condition could not be determined at the time of inspection; the operating hand wheel was missing. (Valve estimated to be 12 inches).

The entrance to the ungated spillway was generally clear of obstructions. Debris and boulders were observed on the floor of the discharge channel, both adjacent to the spillway in the stilling basin and downstream in the adjacent pond. Several boulders have been displaced from the masonry stone walls at the ends of the concrete spillway wingwalls along both sides of the spillway.

c. Reservoir Area. The watershed above the lake is gently to moderately sloping and wooded. A public beach exists along a portion of the left side of the reservoir. Slopes on the shore of the lake appear stable. No evidence of significant sedimentation was observed.

d. Downstream Channel. Erosion has occurred on the right and left banks of the channel immediately downstream of the channel for a distance of 50 to 100 feet. Trees are growing on the banks of the channel downstream of the spillway. Another low dam is located downstream which is ponding water adjacent to the stilling basin.

SECTION 4
OPERATIONAL PROCEDURES

4.1 Procedures

No formal operating procedures were disclosed.

4.2 Maintenance of Dam

No formal maintenance procedures for the dam were found, but from its condition, it is apparent that maintenance is needed to prevent serious deterioration of the structure.

4.3 Maintenance of Operating Facility

No formal maintenance procedures for the operating facilities were disclosed. From the condition of the gate valve stem, it appeared that little maintenance had been done.

4.4 Warning System

No description of any warning system was disclosed.

4.5 Evaluation of Operational Adequacy

Because of the lack of operation and maintenance procedures, the remedial measures described in Section 7.2 should be implemented as prescribed.

SECTION 5
HYDROLOGIC/HYDRAULIC

5.1 Evaluation of Features

a. Design Data. Because no hydrologic or hydraulic data were revealed an evaluation could not be performed.

b. Experience Data. No experience data were found.

c. Visual Observation. The visual inspection revealed that the concrete spillway has a major vertical crack up to 2 inches deep in the downstream face. The spillway abutment walls are eroded and spalled. Some of the stone masonry in the wing walls has fallen. The stilling basin has an accumulation of large stones and debris in it. The valve box for the low-level outlet is of the submerged type on the upstream left end of the spillway. Only the valve stem was observable in the valve box. The pipe and valve are estimated to be 12-inch. The pipe is encased in concrete that measures about 2.5 feet wide by 1 foot deep and the outlet end was essentially blocked by large stones so that the actual size of the pipe could not be determined. The valve stem did not appear to have been operated recently.

d. Maple Lake Overtopping Potential. The hydraulic/hydrologic evaluation for the dam is based on a selected Spillway Design Flood (SDF) equal to one-half the Probable Maximum Flood (PMF) in accordance with the range of test floods given in the evaluation guidelines, for dams classified as high hazard and small in size. The PMF was determined by application of a 24-hour Probable Maximum Storm of 22 inches to the SCS dimensionless unit hydrograph. Hydrologic computations are given in Appendix 4. The routed half-PMF peak discharge for the subject drainage area is 3501 cfs.

The minimum elevation of the dam allows 2.9 feet of depth above the spillway, before overtopping occurs. Under this head the total spillway capacity is 711 cfs, which is less than the selected SDF (approximately 20 percent).

Flood routing calculations indicate that Maple Lake Dam will be overtopped for 6.3 hours to a maximum depth of 2.1 feet under half-PMF conditions. It is estimated that the spillway can pass about 20 percent of the half-PMF without overtopping the dam; thus, the spillway is considered inadequate.

Because of the poor condition of the dam and the High Hazard classification based on visual inspection, a breach analysis was performed to assess the increase in downstream hazard under dam failure conditions. The results of the breach analysis, for the one-half PMF test flood contained in Appendix 5, show that the downstream hazard is not worsened under dam failure conditions.

Under one-quarter PMF conditions, failure of the dam increases the flood stage by 2.2 feet at the damage center. However, it is unlikely that the dam would fail from a one-quarter PMF discharge, which creates 4.3 hours of overtopping to a maximum depth of 0.6 foot.

Because of the poor condition of the dam and the High Hazard classification based on visual inspection, a breach analysis was performed to assess the increase in downstream hazard under dam failure conditions. The results of the breach analysis, for the one-half PMF test flood contained in Appendix 5, show that the downstream hazard is not worsened under dam failure conditions.

Under one-quarter PMF conditions, failure of the dam increases the flood stage by 2.2 feet at the damage center. However, it is unlikely that the dam would fail from a one-quarter PMF discharge, which creates 4.3 hours of overtopping to a maximum depth of 0.6 foot.

SECTION 6
STRUCTURAL STABILITY

6.1 Evaluation of Structural Stability. The presence of a dense growth of trees, brush and vines on the downstream slope, and grass, vines and coarse weed at the downstream edge of the crest makes it impossible to make an adequate visual inspection of the embankment.

Trees growing on the upstream and downstream slopes of the embankment and in the area immediately downstream of the toe may blow over and pull out their roots or they may die with the result that their roots rot. In either case, serious seepage and erosion problems could result.

Erosion immediately adjacent to the right and left spillway wingwalls, if not controlled, could contribute to stability problems in the spillway structure and contribute to a possible breach of the embankment.

The vertical crack in the right spillway abutment wall is evidence of movement. If the movement continues, a spillway and embankment stability problem could result.

The erosion paths and gullies, bare of vegetation from the crest to the downstream toe of the embankment, are susceptible to erosion and consequent damage, owing to runoff of rainfall.

Flow of water in the discharge channel could erode the toe of embankment on the left side of the dam and result in a stability problem of the downstream slope.

The soft, wet area approximately 20 feet downstream of the toe to the left of the spillway channel may be the result of seepage under the dam which, if not properly controlled, could lead to failure of the dam by piping.

Based on the visual inspection alone, it is not possible to determine the character of the dam and spillway foundations or the interior of the cross section of the embankment or the shape of the upstream side of the dam. Therefore, it is not possible to evaluate the factor of safety of the dam and spillway against slope failure, sliding or overturning.

6.2 Design and Construction Data. No design or construction data pertinent to the structural stability of the dam are available.

6.3 Operating Records. No operating records pertinent to the structural stability of the dam were available.

6.4 Post-Construction Changes. "Existing Conditions after Repairs and New Construction", Plan #419, dated March 27, 1947 were done by Frank D. Livermore and are on file at the New Jersey Department of Environmental Protection, Prospect Street, Trenton, New Jersey 08625.

6.5 Seismic Stability. This dam is in Seismic Zone 1. According to the Recommended Guidelines, dams located in Seismic Zone 1 "may be assumed to present no hazard from earthquake provided static stability conditions are satisfactory and conventional safety margins exist." Although no signs of unstable slopes were observed, adequate inspection was impossible because of the dense growth on the downstream crest and the downstream slopes of the dam. Because no data are available concerning the engineering properties of the embankment, foundation materials, or for the condition at the base of the corewall, it is impossible to make an engineering evaluation of the stability of the slopes or the factor of safety under static conditions.

SECTION 7
ASSESSMENT, RECOMMENDATIONS/REMEDIAL MEASURES

7.1 Dam Assessment

a. Condition. Maple Lake Dam is estimated to be perhaps 80 years old and in poor overall condition.

b. Adequacy of Information. The information available is such that the assessment of the dam must be based primarily on the results of the visual inspection.

c. Urgency. The recommendations made in 7.2.a and 7.2.b should be implemented by the owner as prescribed.

d. Necessity for Additional Data/Evaluation. The information available from the visual inspection is adequate to identify the potential problems which are listed in 7.2.a. These problems require the attention of a professional engineer who will have to make additional engineering studies to design or specify remedial measures to rectify the problems. If left unattended, the problems could lead to failure of the dam.

7.2 Recommendations/Remedial Measures

a. Recommendations. The owner should retain a professional engineer qualified in the design and construction of dams to accomplish the following in the time periods specified:

Immediately:

Design and oversee procedures for the removal of trees, vines, and brush from the upstream and downstream slopes and for a distance of 25 feet from the downstream toe of the dam or limits of property, whichever is less.

Starting Soon:

1. Design and oversee repairs for the eroded areas on the downstream slope adjacent to the spillway, along the toe, and at the footpaths near the steel grating stairway.

2. Design necessary remedial measures to prevent erosion of the toe by water flowing in the discharge channel downstream from the spillway.

3. Design or specify repairs for the erosion of the upstream slope of the dam and design and specify erosion protection for the upstream slope of the dam.

4. Investigate the cause of the wet, soft area 20 feet downstream from the toe of the dam near the left bank of the spillway channel.

5. Design or specify reconstruction of the spillway and abutment walls.

6. Design or specify repairs to the low level outlet.

7. Design and oversee repairs to the cracked concrete core walls and upstream concrete walls.

In the near Future:

1. Perform a more detailed hydrologic/hydraulic evaluation of the inadequacy of the spillway and design and implement necessary increased capacity.

2. Backfill animal burrows with properly selected materials.

b. Operating and Maintenance Procedures. The owner should accomplish the following very soon.

1. Start a program of checking the condition of the dam periodically and monitoring the wet area downstream from the toe of the downstream slope.

2. Clear trees and brush from the discharge channel and from a zone 25 feet on either side of the discharge channel or to the property line, whichever is the lesser distance, from the spillway stilling basin to the next pond downstream.

3. Control trespassing on dam.

4. Start a program for maintaining the embankment free of weeds, brush, vines, and trees.

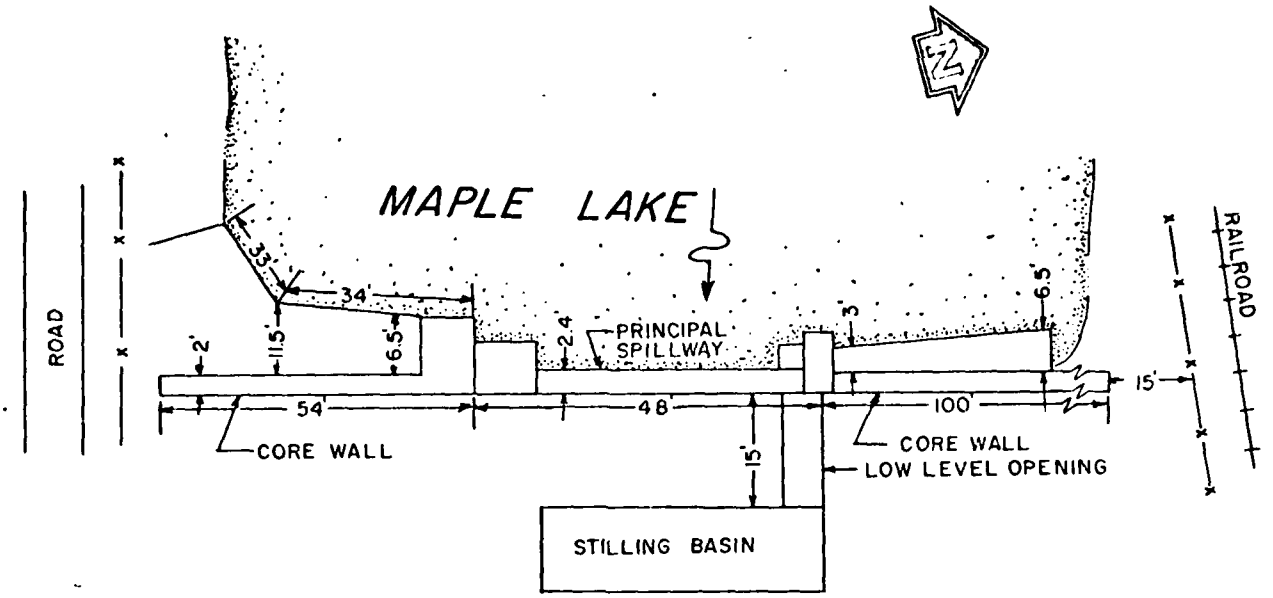
Starting Soon:

Develop an emergency action plan which outlines actions taken by the owner to minimize downstream effects of an emergency at the dam.

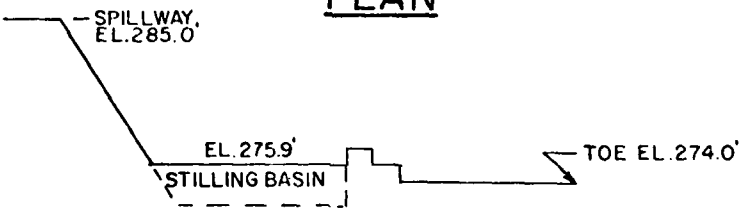
5. Repair steel stairs on downstream face of dam.

In the near Future:

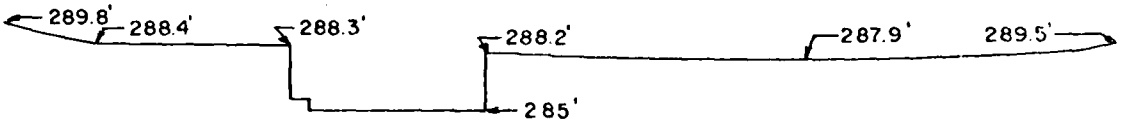
Develop written operating procedures and a periodic maintenance plan to ensure the safety of the dam.

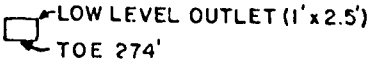


PLAN



PROFILE





ELEVATION

Anderson-Nichols & Co, Inc. BOSTON MASSACHUSETTS	U.S. ARMY ENGINEER DIST PHILADELPHIA CORPS OF ENGINEERS PHILADELPHIA, PA
NATIONAL PROGRAM OF INSPECTION OF NON-FED. DAMS	
MAPLE LAKE DAM	
GOFFLE BROOK NEW JERSEY	
	SCALE NOT TO SCALE
	DATE JUNE 1981

FIGURE -1

Anderson-Nichols & Co., Inc. BOSTON MASSACHUSETTS	U.S. ARMY ENGINEER DIST. PHILADELPHIA CORPS OF ENGINEERS PHILADELPHIA, PA.

NATIONAL PROGRAM OF INSPECTION OF NON-FED. DAMS

MAPLE LAKE DAM
LOCATION MAP

GOFFLE BROOK NEW JERSEY

SCALE: 1" = 4 Miles Approx.

DATE: JUNE 1981

SCALE IN MILES

0 4 8

MAP BASED ON STATE OF NEW JERSEY OFFICIAL MAP & GUIDE.

FIGURE-1

APPENDIX 1

ENGINEERING AND

EXPERIENCE DATA

MAPLE LAKE DAM

April 5, 1957

Mr. Garfield E. Avegarde
Maple Lake Club
Maple Drive
Wyckoff, New Jersey

Re: Application No. 419

Dear Mr. Avegarde:

This is in reply to your recent letter relative to your proposal to relocate Goffle Brook, near the point where it enters Maple Lake, near Wortendyke, in Bergen County.

Kindly forward a map or sketch of your property and indicate thereon the extent and location of the proposed relocation. Upon receipt of this information, you will be advised further.

Very truly yours,

George R. Shanklin
Chief Engineer and
Acting Director

RCS:mm

NCW

DRAINING PERMIT

Effective Date--March 18, 1957

TO WHOM IT MAY CONCERN:

Pursuant to the provisions of Section 23:6-29, Revised Statutes, permission is hereby granted to

E. G. AVOGARDO
804 Maple Drive
Wyckoff, New Jersey

to drain the waters of Maple Lake, for the purpose of cleaning and making necessary repairs, under the supervision of Warden Garret Westerveld, provided measures are taken to prevent the destruction of the fish.

This permit expires April 18, 1957.

Director

JVH
cc. Westerveld
Water Policy
Fisheries Lab.

March 4, 1959

Mr. E. O. Avegardo
204 Maple Drive
Wyckoff, New Jersey

Re: Dam Application No. 419

Dear Sir:

This Division has been advised that you are contemplating repairs to the Maple Lake Dam across Goffle Brook, near Hortendyke, in Bergen County. This dam was repaired about ten years ago by the former owners, Mr. & Mrs. John H. Bell.

Enclosed for your information is a copy of our booklet entitled, "Information for Applicants for Construction, Alteration or Repair of Dams". This booklet contains excerpts from the Statutes as well as the Rules and Regulations of this Division relative to the construction, reconstruction or repair of dams. Kindly advise the nature of repairs which you contemplate in order that a determination can be made as to the necessity for your obtaining a permit from this Division for such repairs.

Very truly yours,

Herman C. Wittwer
Assistant Chief Engineer

HCW:mm
Enc.

DAM APPLICATION NO. 129.....

NCW

N.J. DEPARTMENT OF CONSERVATION

DIVISION OF WATER POLICY & SUPPLY

ACCEPTANCE OF PERMIT FOR CONSTRUCTION OR REPAIR OF DAM

DEPT. OF CONSERVATION RECEIVED APR 14 1947 DIVISION OF WATER POLICY & SUPPLY

Division of Water Policy & Supply
Trenton, N. J.

Gentlemen:

We hereby acknowledge receipt of your permit issued ....April 7/47.... in response to our application for permit for the construction (or repair) of ....[illegible].... across ....[illegible] Brook.... (Name of Stream) at (near) ....[illegible], N.J.....

We hereby accept and agree to abide by and fulfill the terms and conditions therein imposed in carrying out the construction work therein authorized.

John M. [illegible]
Name of Applicant

[illegible]
Address
N.J.
Box 343

....April 11....1947

Form 10 WC-18-40

Dam Application No. 419
(23-47)

State of New Jersey

State Water Policy Commission

REPORT ON DAM APPLICATION

To the State Water Policy Commission,
State of New Jersey.

Gentlemen:

The application of John P. Sell, P. O. Box 343, Wortendyke, N. J.

filed August 7, 1945 for approval of plans and for a permit to repair a dam
(plans filed Mar. 17, 1947)
known as Maple Lake near Wortendyke on Goffle Brook

tributary to Passaic River in Bergen County, New Jersey,

has been examined by Norman C. Wittwer, Hydraulic Engineer.

PRINCIPAL FEATURES

Location 23.42.3.1.5 [5]	Site inspected 9/27/45 - G.R.S. 6/10/46 - N.C.W.
Purpose of dam Semi-public swimming pool	Length of dam 355 feet
Drainage area 2.3 sq. mi.	Elevation of flow line 265.0 (U.S. Coast & Geodetic Datum)
Area of lake 5.0± acres	Capacity of lake 3.5 Mill. gals.
Type of dam Earth fill with concrete core wall	Top width 8± feet
Upstream slope Vertical concrete wall	Downstream slope 1½:1 approx.
Foundation material Unknown	Max. height 13 feet
Type of spillway Concrete wall, C = 3.3	Length of spillway 48 feet
Max. head on spillway 3.3 feet dam awash	
Spillway capacity 947 sec. ft. = 411	sec. ft. per sq. mi. dam awash
Estimated maximum flood flow 403	sec. ft. per sq. mi. mean North & Central

Outlets other than spillway Concrete culvert 25" x 36" high

Drawings filed by Frank D. Livermore - N. J. License 991

It has been found that the site for the dam is suitable and the plans adequate to ensure the construction of a structure which will not be a menace to life or property. It is therefore recommended that the plans be approved and that a permit be issued, subject, however, to the following terms and conditions:—

1. That this permit does not give any property rights, either in real estate or material, nor any exclusive privileges; neither does it authorize any injury to private property nor invasion of private rights, nor any infringement of Federal, State or local laws or regulations, nor does it waive the obtaining of Federal assent, when necessary.

STATE OF NEW JERSEY
DEPARTMENT OF CONSERVATION
Division of Water Policy and Supply
28 West State Street
Trenton, New Jersey

TRENTON, NEW JERSEY

DAM APPLICATION No. 419

APPLICATION FOR PERMIT FOR CONSTRUCTION OR REPAIR OF DAM

Wyckoff New Jersey

Aug 6 1945

To the New Jersey State Water Policy Commission,

Gentlemen:—

In compliance with the provisions of Title 58, Chapter 4, Revised Statutes John M. Sell [illegible] N. J. Box 343
(Here insert name and address of public authority, private person or corporation which will be the owner of the dam)

hereby makes application for the approval of drawings and for the issuance of a permit to construct (repair) a Embankment dam known as Maple Lake [illegible]
(Here insert name of dam)

across Goffle Brook in Bergen County, New Jersey,
(Here insert name of stream)

at a point 600 ft
(Here give location by distance from mouth of stream, county or municipal boundary or other political feature)

for the purpose of Private used as a membership Club
(Here state the purpose of the proposed lake)

in accordance with the following information and with the complete specifications and drawings filed with this application and made part hereof, as follows:

Area of water shed 28 square miles

Maximum depth of lake 6 1/2 feet

Area of water surface 5 acres

Capacity of spillway at 4.0 + 2 feet head, is cubic feet per second.

The character of the foundation material is [illegible] & [illegible]

As determined by John M. Sell

APPENDIX 2

CHECK LIST

VISUAL INSPECTION

MAPLE LAKE DAM

Check List
Visual Inspection
Phase 1

Name Dam Maple Lake County Bergen State NJ (00776) Coordinators NJDEP

Date(s) Inspection 2/17/81, 4/23/81 Weather Rain, Rain Temperature 50°, 55°

Pool Elevation at Time of Inspection 285 NGVD Tailwater at Time of Inspection 276.3 NGVD

Inspection Personnel:

Guinan	Murdock
Stone	
Gilman	

Gilman/Stone Recorder

The owner was not present during inspection.

VISUAL EXAMINATION OF	OBSERVATIONS	REMARKS OR RECOMMENDATIONS
SURFACE CRACKS CONCRETE SURFACES	Right side - several transverse hairline cracks thru apron and 2 ft wall. Surface of concrete is eroded to expose coarse aggregate. 3 ft d/s concrete wall visible in few places. Some cracking and spalling on right end. Left side - u/s concrete wall has 4 transverse cracks, with one badly spalled and eroded. Surface laitance eroded from all concrete.	Repair cracking
STRUCTURAL CRACKING	Several transverse hairline cracks.	Repair cracking
VERTICAL AND HORIZONTAL ALIGNMENT	No indication of movement.	
MONOLITH JOINTS	Not visible.	
CONSTRUCTION JOINTS	Steel stairs on d/s right side - Steel treads, stringers and railing badly corroded.	

UNGATED SPILLWAY

VISUAL EXAMINATION OF	OBSERVATIONS	REMARKS OR RECOMMENDATIONS
CONCRETE WEIR	Concrete abutments are badly spalled, cracked and eroded. Poor condition. Top of weir is spalled and eroded exposing 6-in cable. D/s face is surface eroded with a vertical crack near center that is eroded to a depth of 2 inches ±.	Major reconstruction required.
APPROACH CHANNEL	Maple Lake	
DISCHARGE CHANNEL	Concrete wall at d/s of stilling basin is surface eroded 3/4 inch exposing coarse aggregate - Rock debris.	
BRIDGE AND PIERS OVER SPILLWAY	Not applicable.	

OUTLET WORKS

VISUAL EXAMINATION OF	OBSERVATIONS	REMARKS OR RECOMMENDATIONS
CRACKING AND SPALLING OF CONCRETE SURFACES IN OUTLET CONDUIT	Valve of unknown diameter, some spalling. Concrete on the u/s and d/s of the intake and discharge conduit is badly spalled and eroded.	Repair concrete
INTAKE STRUCTURE	Concrete is spalled and chamber is filled with debris. Valve stem visible under water.	Repair concrete
OUTLET PIPE	1 ft x 2½ ft. *End covered with debris.*	Clear
OUTLET CHANNEL	Rocky and filled with debris.	Clear
EMERGENCY GATE	Not visible.	

EMBANKMENT

VISUAL EXAMINATION OF	OBSERVATIONS	REMARKS OR RECOMMENDATIONS
SURFACE CRACKS	Spalled and cracked corewall on right (south) side.	Repair concrete
UNUSUAL MOVEMENT OR CRACKING AT OR BEYOND THE TOE	None	
SLOUGHING OR EROSION OF EMBANKMENT AND ABUTMENT SLOPES	Erosion gullies of widths up to 3 feet, 4 to 8 inches deep have developed on the d/s slope.	Repair erosion and provide adequate erosion protection.
VERTICAL AND HORIZONTAL ALIGNMENT OF THE CREST	Not applicable	
RIPRAP FAILURES	Not applicable	

EMBANKMENT

VISUAL EXAMINATION OF	OBSERVATIONS	REMARKS OR RECOMMENDATIONS
RAILINGS	None	
JUNCTION OF EMBANKMENT AND ABUTMENT, SPILLWAY AND DAM	Erosion adjacent to both right and left spillway wingwalls. Cracks in right training wall of spillway.	Repair erosion and provide adequate erosion protection, repair cracks.
ANY NOTICEABLE SEEPAGE	None	
STAFF GAGE AND RECORDER	None	
DRAINS	None	

DOWNSTREAM CHANNEL

VISUAL EXAMINATION OF	OBSERVATIONS	REMARKS OR RECOMMENDATIONS
CONDITION (OBSTRUCTIONS, DEBRIS, ETC.)	Some debris, dam 200 feet d/s. No pond behind it.	
SLOPES	Steep on right, mild low slope on left.	
APPROXIMATE NO. OF HOMES AND POPULATION	*1 house - estimate 6 persons.*	

RESERVOIR

VISUAL EXAMINATION OF	OBSERVATIONS	REMARKS OR RECOMMENDATIONS
SLOPES	Appear stable	
SEDIMENTATION	No evidence of significant sedimentation was observed.	

CHECK LIST
ENGINEERING DATA
DESIGN, CONSTRUCTION, OPERATION

ITEM	REMARKS
PLAN OF DAM	Plan #419 "Existing conditions after repairs and new construction" filed March 27, 1947 are on file at the New Jersey Department of Environmental Protection, Prospect Street, Trenton, New Jersey 08625
REGIONAL VICINITY MAP	Prepared for this report
CONSTRUCTION HISTORY	None found
TYPICAL SECTIONS OF DAM	Existing spillway, new concrete cap and new concrete addition. See "PLAN OF DAM" above.
HYDROLOGIC/HYDRAULIC DATA	None found
OUTLETS - PLAN	None found
- DETAILS	None found
- CONSTRAINTS	None found
- DISCHARGE RATINGS	None found
RAINFALL/RESERVOIR RECORDS	None found

ITEM	REMARKS
MONITORING SYSTEMS	None
MODIFICATIONS	None
HIGH POOL RECORDS	None
POST CONSTRUCTION ENGINEERING STUDIES AND REPORTS	None
PRIOR ACCIDENTS OR FAILURE OF DAM DESCRIPTION REPORTS	None
MAINTENANCE OPERATION RECORDS	None

ITEM	REMARKS
DESIGN REPORTS	None found
GEOLOGY REPORTS	None found
DESIGN COMPUTATIONS HYDROLOGY & HYDRAULICS DAM STABILITY SEEPAGE STUDIES	None found
MATERIALS INVESTIGATIONS BORING RECORDS LABORATORY FIELD	None found
POST-CONSTRUCTION SURVEYS OF DAM	See "PLAN OF DAM" on previous page
BORROW SOURCES	Unknown

ITEMS	REMARKS
SPILLWAY PLAN	See "PLAN OF DAM"
SECTIONS	None
DETAILS	None
OPERATING EQUIPMENT PLANS & DETAILS	None

CHECK LIST
HYDROLOGIC AND HYDRAULIC DATA
ENGINEERING DATA

DRAINAGE AREA CHARACTERISTICS: 2.21 square miles, woods, small urban area

ELEVATION TOP NORMAL POOL (STORAGE CAPACITY): 285' NGVD (38.4 acre-feet)

ELEVATION TOP FLOOD CONTROL POOL (STORAGE CAPACITY) Not applicable

ELEVATION MAXIMUM TESTFLOOD POOL: 289.3' NGVD

ELEVATION TOP DAM: 287.9' NGVD

SPILLWAY CREST: Uncontrolled concrete

a. Elevation 285' NGVD

b. Type Broad crested

c. Width 2.4 feet

d. Length 48 feet

e. Location Spillover Center of dam

f. Number and Type of Gates None

OUTLET WORKS: Low level outlet

a. Type Estimated 12-inch pipe contained in a 1 foot x 2.5 foot concrete box

b. Location Next to spilling basin on downstream side

HYDROMETEOROLOGICAL GAGES: None

MAXIMUM NON-DAMAGING DISCHARGE: 711 cfs

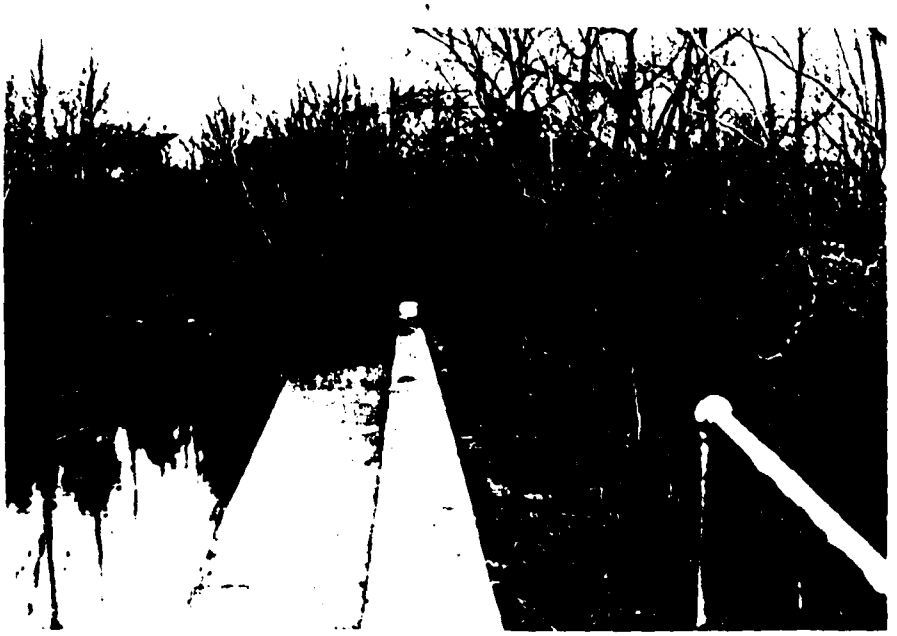
APPENDIX 3

PHOTOGRAPHS

MAPLE LAKE DAM

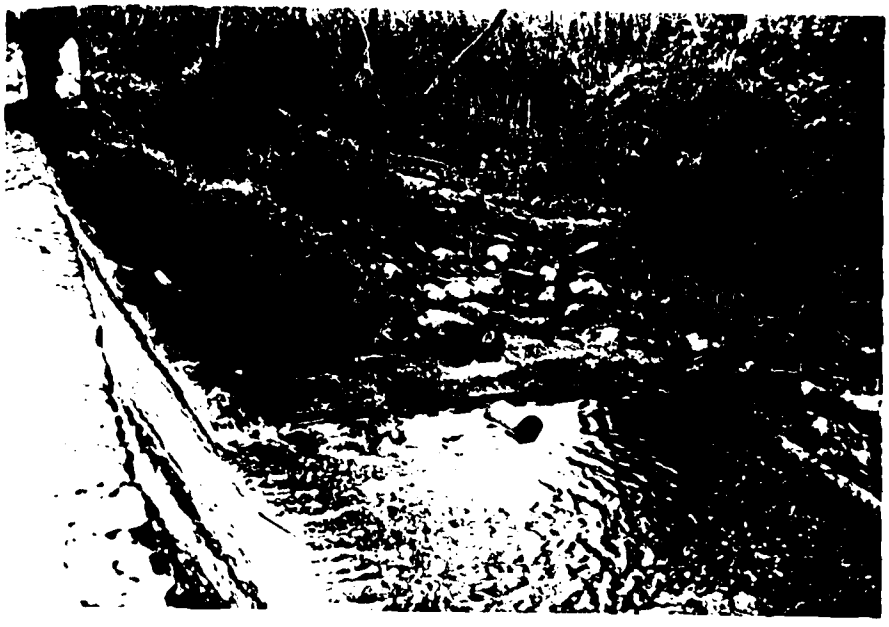
April 23, 1981

View of upstream face of dam at right abutment; dam appears to have a 2-ft wide corewall.



April 23, 1981

View along corewall toward left abutment.



April 23, 1981

View erosion along left side of spillway channel.

April 23, 1981

View of downstream channel where it joins adjacent pond below bridge

April 23, 1981

View of low-level outlet hidden behind stones. Concrete casing of low-level pipe is clearly visible, extending d/s from face of spillway.

April [illegible]

View of contact between gill [illegible] training wall on left (north) side.

April 25, 1984

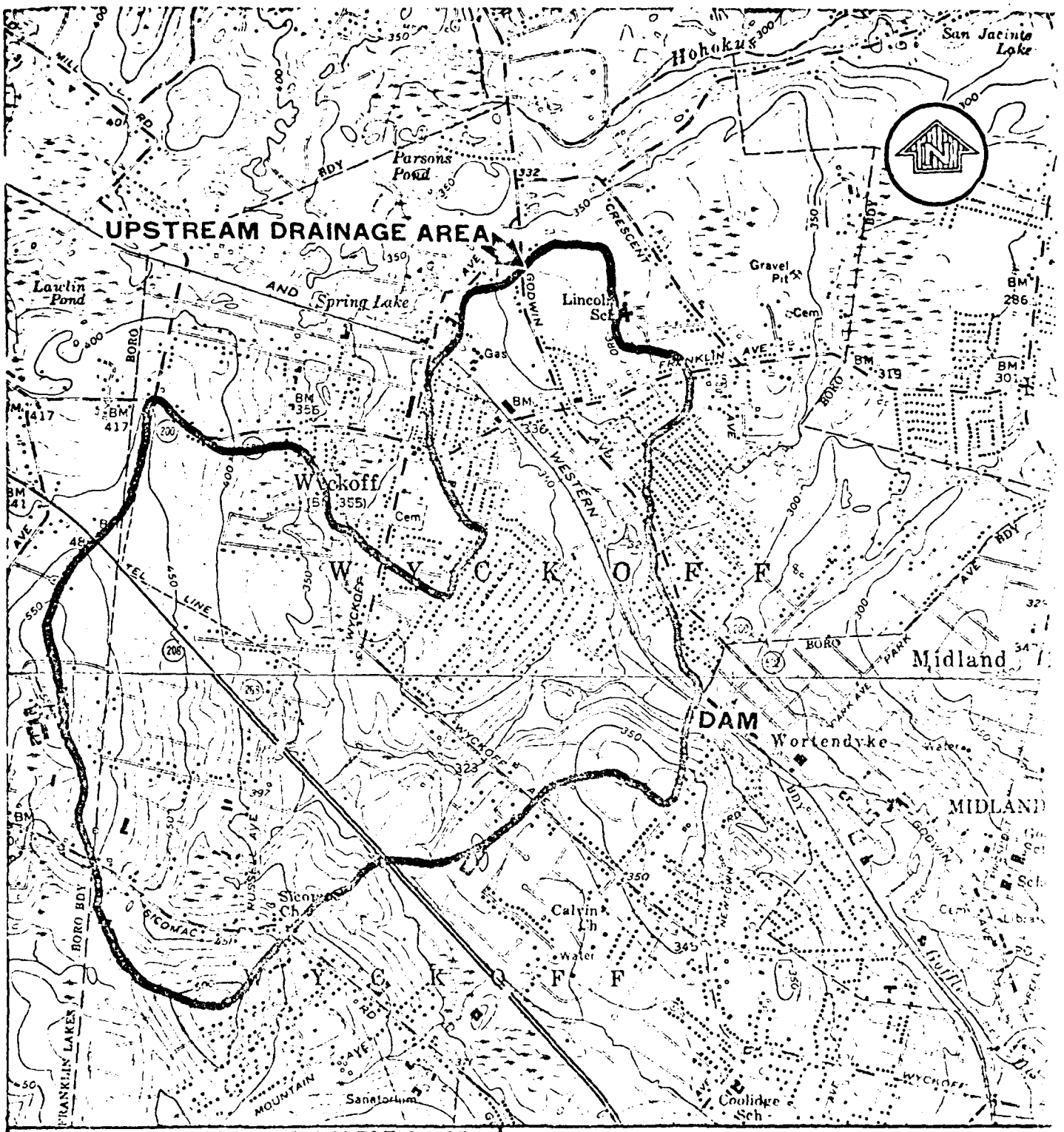
Close-up view of crack and spalling in spillway d/s face.

View of extensive root growth downstream of right side of dam.

APPENDIX 4

HYDROLOGIC COMPUTATIONS

MAPLE LAKE DAM



NATIONAL PROGRAM OF INSPECTION OF NON-FED. DAMS

MAPLE LAKE DAM

WYCKOFF TOWNSHIP, NEW JERSEY

REGIONAL VICINITY MAP

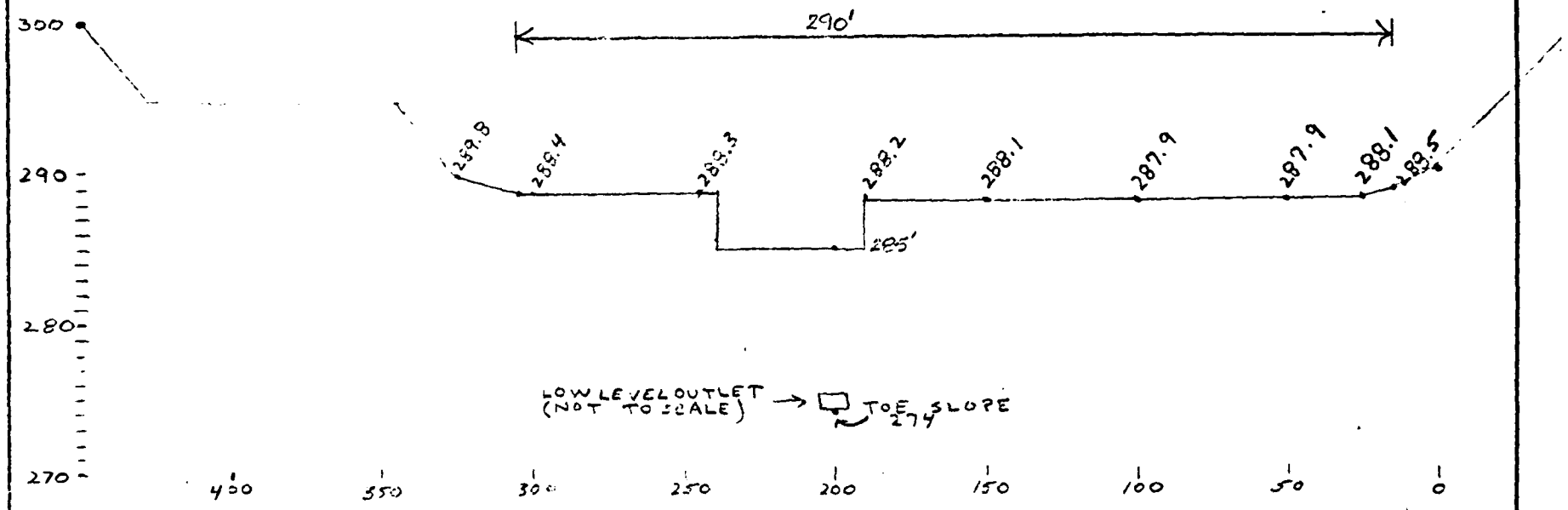
DEPARTMENT OF THE ARMY
PHILADELPHIA DISTRICT, CORPS OF ENGINEERS
PHILADELPHIA, PENNSYLVANIA

Anderson-Nichols & Company, Inc. BOSTON, MA.

SCALE IN MILES

0 1/2 1

MAP BASED ON U.S.G.S. 7.5 MINUTE QUADRANGLE SHEETS. RAMSEY, N.J., N.Y. 1955, AND PATERSON, N.J., 1955, REVISED 1970.



ANDERSON-NICHOLS

VERNON BOSTON CONCORD

MAPLE LAKE
SM DAM FACE

DATE	SCALE:	JOB NO.	SHEET NO.
6/11/91			1 OF 1

Anderson-Nichols & Company, Inc.

Subject MOUNT LAKE DAM

Sheet No. 2 of 14

Date [illegible]

Computed [illegible]

Checked [illegible]

JOB NO. 3671-08

SQUARES /4 IN. SCALE

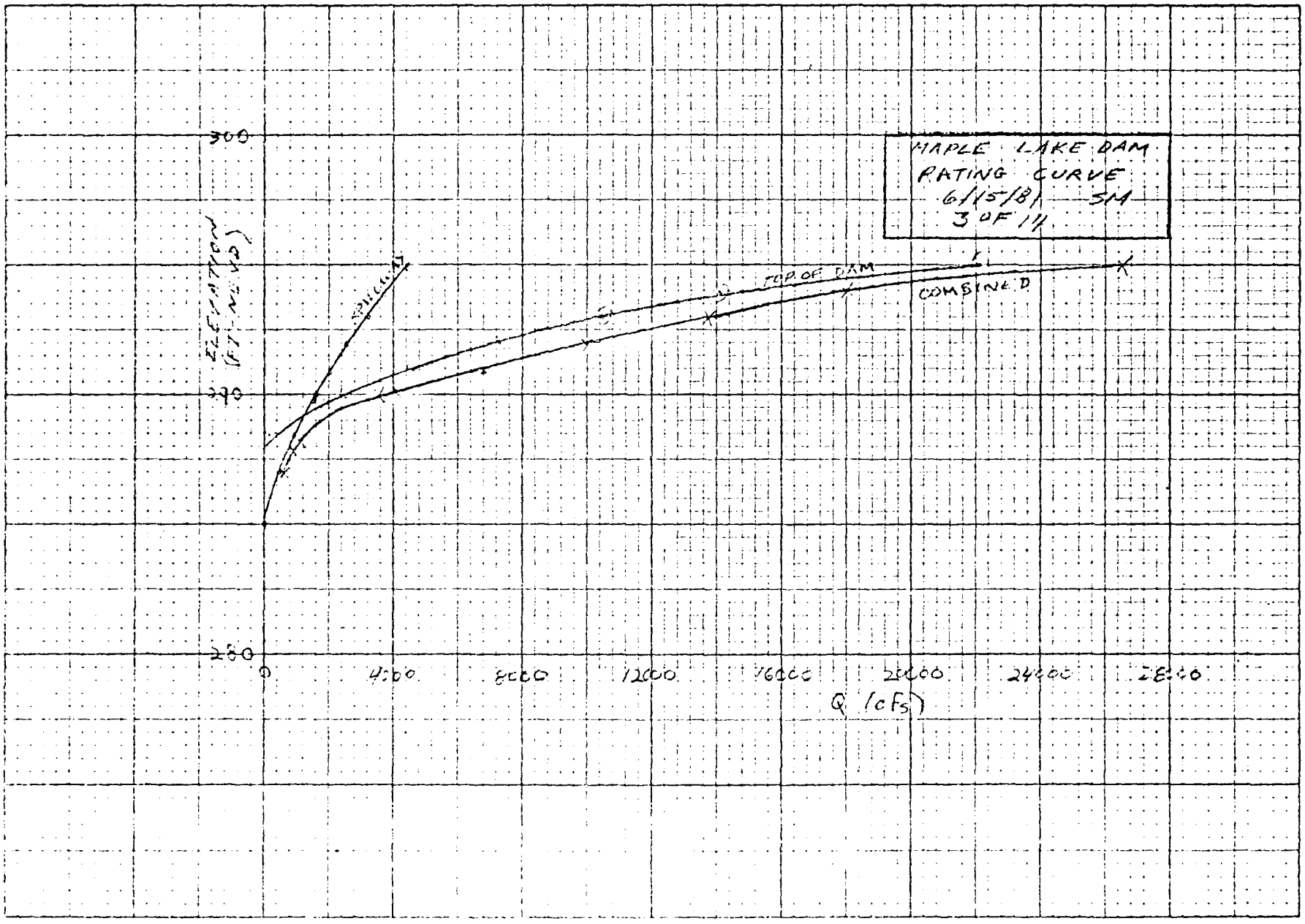
DEVELOPMENT OF RATING CURVE

$Q = CLH^{3/2}$

1) SPILLWAY CURVE
C = 3.0 BREADTH = 2.4 FT
WEIR LENGTH = 48 FT

2) TOP OF DAM
C = 2.6 BREADTH = 15 FT
WEIR LENGTH = 242 FT (W/O [illegible])

	ELEVATION (FT-NGVD)	SPILLWAY HEAD (FT)	SPILLWAY CFS	TOP OF DAM HEAD (FT)	TOP OF DAM [illegible]	DAM [illegible]	[illegible] (CFS)
SPILLWAY	285	0	0				
	287.0	2.0	407				407
TOP DAM	287.1	2.9	711				711
	289.1	3.1	786	0.2	138	32	818
	290.4	4.4	903	0.5	290	967	1170
	289.8	4.8	1514	1.9	310	2111	3625
	290.0	5.0	1610	2.1	327	2554	4164
	291.0	6.0	2110	3.1	334	4740	6850
	292.0	7.0	2667	4.1	342.5	7593	10260
	293.0	8.0	3258	5.1	352.5	10756	14014
	294.0	9.0	3886	6.1	361	14141	18027
	295.0	10.0	4554	7.1	450.5	22159	26713



Anderson-Nichols & Company, Inc. Subject MAPLE LAKE DAM Sheet No. 4 of 14
Date 6/[illegible]/81
Computed [illegible]
Checked [illegible]
JOB NO. 3671-08

TIME OF CONCENTRATION

METHOD #1 TEXAS HIGHWAY METHOD

OVERLAND FLOW

REACH LENGTH = 4000 ft

SLOPE $= \frac{560-350}{4000} = 0.053 = 5.3\%$

FROM TABLE "WOODLANDS"
AVG. VELOCITY = 2.0 fps
4000 ft ÷ 2.0 fps = 2000 sec = 33.3 min

CHANNEL FLOW

REACH LENGTH = 8800 ft

SLOPE $= \frac{350-286}{8800} = .0073 = .73\%$

FROM TABLE, AVG VELOCITY = 2.0 fps
8800 ft ÷ 2.0 fps = 4400 sec = 73.3 min

Tc = 33.3 min + 73.3 min = 106.6 min = 1.8 hrs

METHOD #2 SOIL AND WATER CONSERVATION

$L = 0.6\,T_c$ $\quad L = \frac{\ell^{0.8}(S+1)^{1.67}}{9000\,Y^{0.5}}$ $\quad S = \frac{1000}{CN} - 10$

TAKE CN = 70 FOR WOODS $\quad S = \frac{1000}{70} - 10 = 4.3$

$\ell = 4000 + 8800 = 12800\,ft$ $\quad Y = \frac{560-286}{(12800)} = .021[illegible]$

$L = \frac{(12800)^{0.8}(4.3+1)^{1.67}}{9000\,(2.1)^{0.5}} = 2.40\ hrs$

$T_c = \frac{2.40}{.6} = 4.0\ hrs$

Anderson-Nichols & Company, Inc.

Subject: MARIE LAKE DAM

Sheet No. 5 of 14

JOB NO. 3671-08

SQUARES 1/4 IN. SCALE

METHOD #3 SCS TR #55

OVERLAND FLOW

LENGTH = 4000 ft
HEAD = 210 ft
SLOPE = .053 = 5.3 %

FROM FIGURE AVG VEL = .67 fps

$$T_c = \frac{4000\text{ ft}}{3600(.67)\text{ fps}} = \underline{1.7\text{ hrs}}$$

CHANNEL FLOW

LENGTH = 8800 ft
HEAD = 54 ft
SLOPE = .0073 = .73 %
n = .04

$$V = \frac{1.49}{n} R^{2/3} S^{1/2}$$ (Assume a 5'×2' rectangular channel ...)

$$R = \frac{\text{Area}}{\text{wetted perim}} \quad \frac{10}{2\cdot2+5} = 1.11\text{ ft}$$

$$V = \frac{1.49}{.04}(1.11)^{2/3}(.0073)^{1/2} = 3.41\text{ fps}$$

$$T_c = \frac{8800\text{ ft}}{3.41\text{ fps}} = 2580.6\text{ sec} = .72\text{ hr}$$

Total T_c = 1.7 hrs + .72 hrs = <u>2.4 hrs</u>

METHOD #4 KIRBY METHOD

OVERLAND FLOW

$$T_c = 0.83 \left(\frac{NL}{\sqrt{S}} \right)^{0.467}$$

$N = .6$
$S = .053$
$L = 4000$

$$T_c = 0.83 \left(\frac{(.6)(4000)}{\sqrt{.053}} \right)^{0.467}$$

$= 62.4$ min $= 1.04$ hrs.

CHANNEL FLOW

USE MANNING AS IN METHOD #3
$V = 3.41$ fps
$T_c = \frac{8800 \text{ ft}}{3.41 \text{ fps}} = 2580.6$ sec $= .72$ hr

TOTAL $T_c = 1.04$ hrs $+ .72$ hrs $= \underline{1.8 \text{ hrs}}$

AVERAGE T_c FROM 4 METHODS:

$$\frac{1.8 \text{ hrs} + 4.0 \text{ hrs} + 2.4 \text{ hrs} + 1.8 \text{ hrs}}{4} = 2.5 \text{ hrs}$$

$T_{c\,AVG} = 2.5$ hrs.

$T_L = .6\, T_c$

$T_L = \underline{1.5 \text{ hrs}}$

Anderson-Nichols & Company, Inc.

Subject MAPLE LAKE DAM

Sheet No. 7 of 14
Date 6/[illegible]
Computed SM
Checked [illegible]

JOB NO. 3671-08

SQUARES /4 IN. SCALE 0 1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20 21 22 23 24 25 26 27 28 29

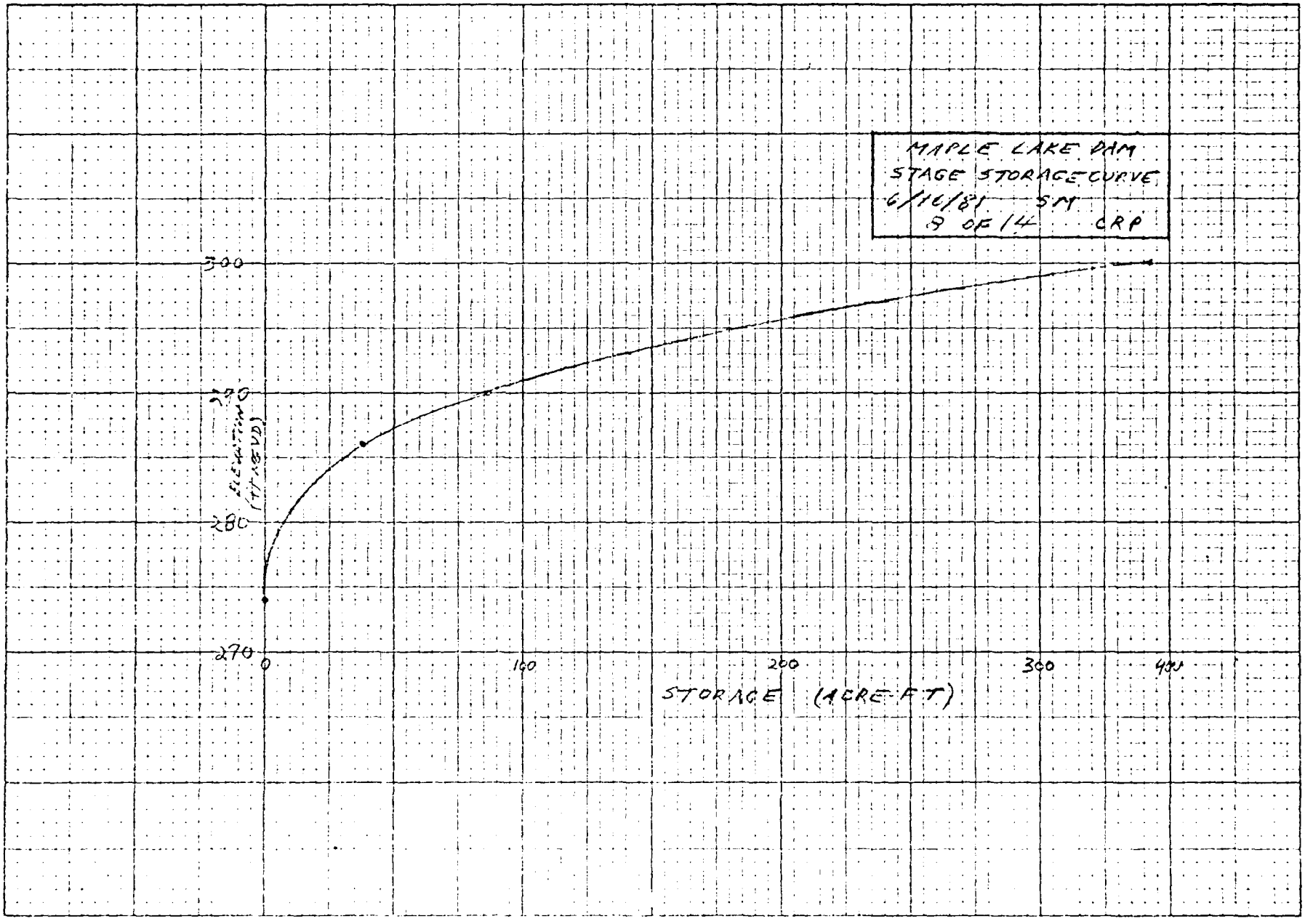
STAGE - STORAGE DETERMINATIONS

TAKE DEPTH OF LAKE TO BE 6 ft

ELEVATION FT	SURFACE AREA ACRES	AVG S.A ACRES	INCREMENTAL STORAGE AC-FT	CUMMULATIVE STORAGE AC-FT
		6.4	38.4	
285	6.4			38.4
		9.6	48	
290	12.8			86.4
		25.6	256	
300	38.4			342.4

INPUT FOR HEC I (FROM CURVE)

STAGE	STORAGE
274.0	0
285.0	38.4
287.9	57.5
288.3	63.0
289.8	85.0
290.0	86.4
295.0	185.0
300.0	342.4



Anderson-Nichols & Company, Inc.

Subject _____

Sheet No. 4 of 14
Date _____
Computed _____
Checked _____

JOB NO. 3671-08

SQUARES /4 IN. SCALE

DETERMINATION OF "C" FOR LOW LEVEL OUTLET

D = DIAMETER = 12 INCHES (ASSUMED)

n = 0.013 (KYLE 5.15)

A_p = AREA OF PIPE OPENING = .79 ft²

L_p = 40 ft (ESTIMATED)

K_f = FRICTION LOSS THROUGH PIPE

$$K_f = \frac{187 n^2}{D^{4/3}} = \frac{5087 (.013)^2}{(12)^{4/3}} = .051$$

K_L = ENTRANCE LOSS TO PIPE = 0.8 (K

C_p = COEFFICIENT OF DISCHARGE

$$C_p = A_p \sqrt{\frac{2g}{1 + K_f L_p}} = .79 \sqrt{\frac{64.4}{1 + .8 + (.051)(40)}} = 3.$$

$$C = \frac{C_p / A}{\sqrt{D}} = \frac{3.6/.79}{\sqrt{12}} = 0.57$$

Anderson-Nichols & Company, Inc.

Subject Maple Lake Dam

Sheet No. 10 of 14
Date
Computed
Checked CLP

JOB NO. 3671-08

SQUARES 0 1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20 21 22 23 24 25 26 27 28 29
1/4 IN. SCALE

DRAWDOWN BY LOW LEVEL OUTLET

ASSUME: 1) NO SIGNIFICANT INFLOW

2) ONE 12 INCH PIPE

3) $Q_p = C_p H^{1/2} = 3.6 H^{1/2}$

4) ACRE FT/DAY = .9835 × Q AVG

5) DAYS = Δ STORAGE / AVG Q

ELEV	STORAGE (ACRE-FT)	ΔS	H* FT	Q_p CFS	AVG Q CFS	ΔS / AVG Q	DAYS
288	38.4		10.5	11.7			
		30.9			10.0	19.8	1.6
280	7.5		5.5	8.4			
		6.5			5.5	10.9	1.0
275	1.0		.5	2.5			
		1			1.3	2.6	0.4
274	0		0	0			

TOTAL = 3.0 DAYS

* from mid-point of pipe (274.5' USGS)

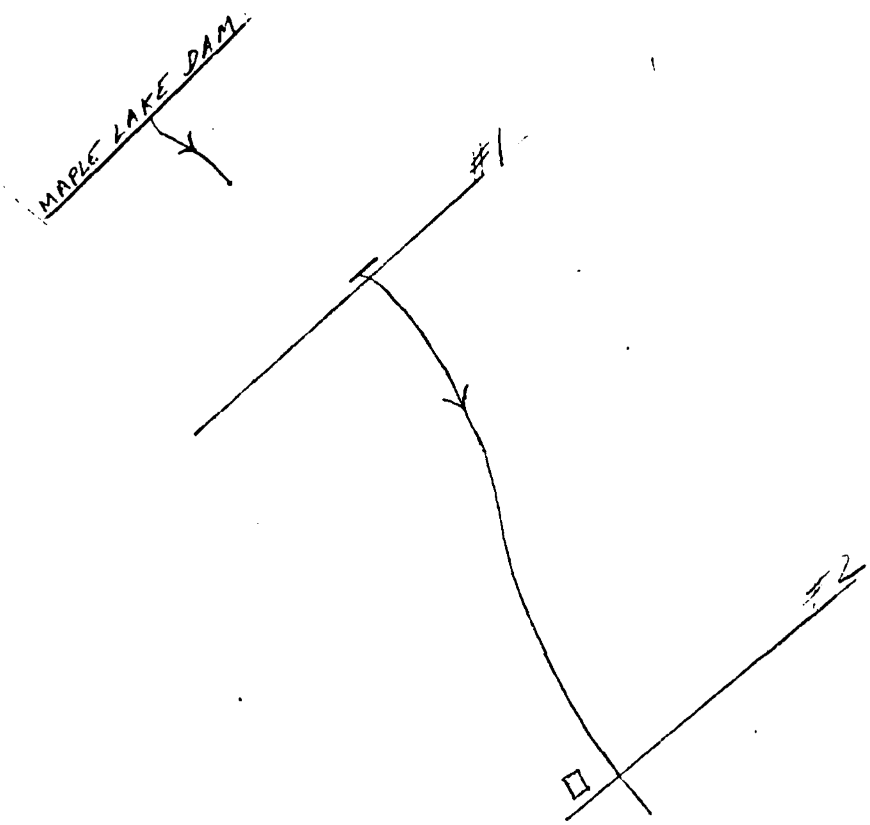
Anderson-Nichols & Company, Inc.

Subject MAPLE LAKE DAM

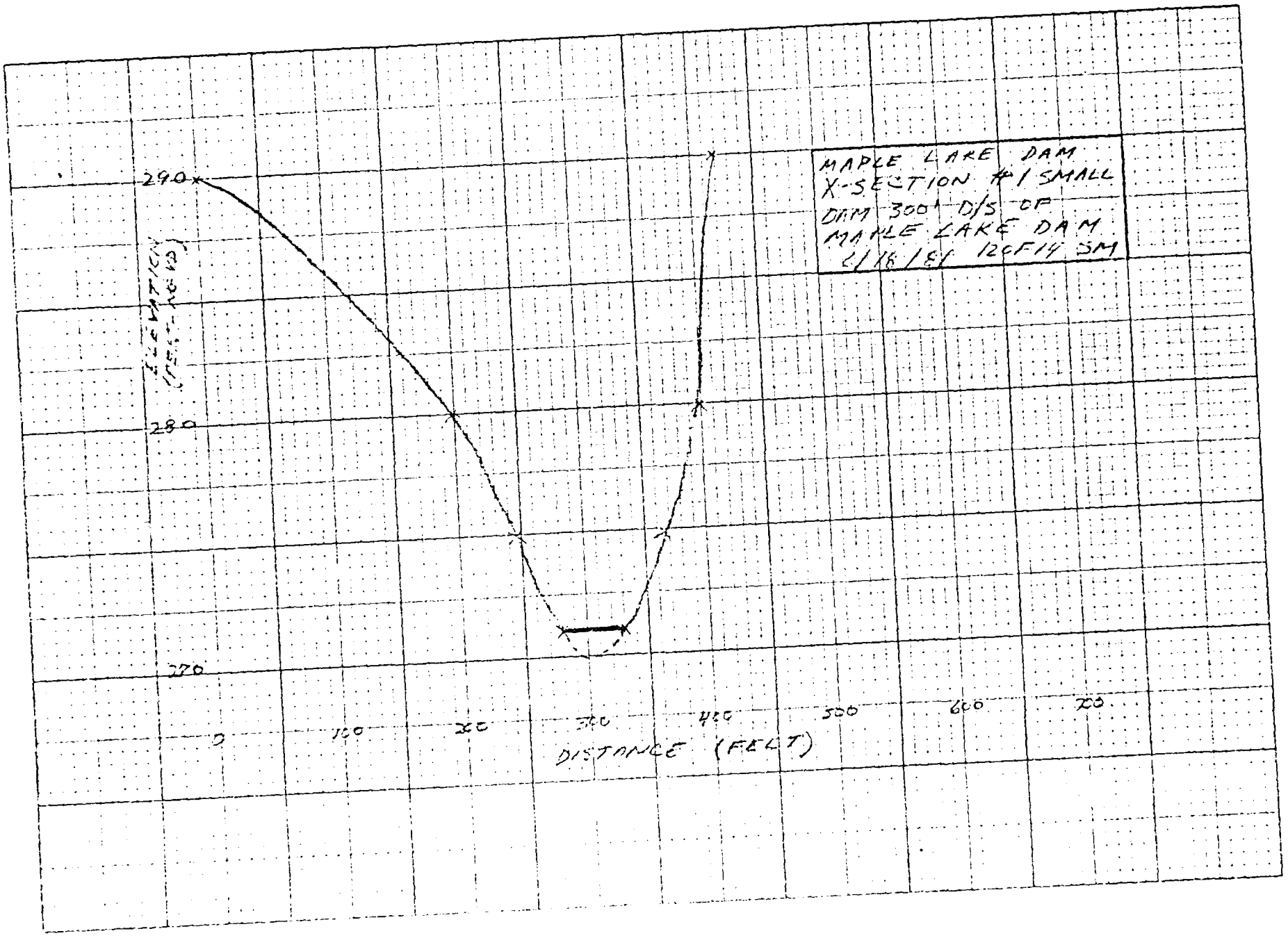
Sheet No. 11 of 14
Date 6-18-81
Computed SFA
Checked

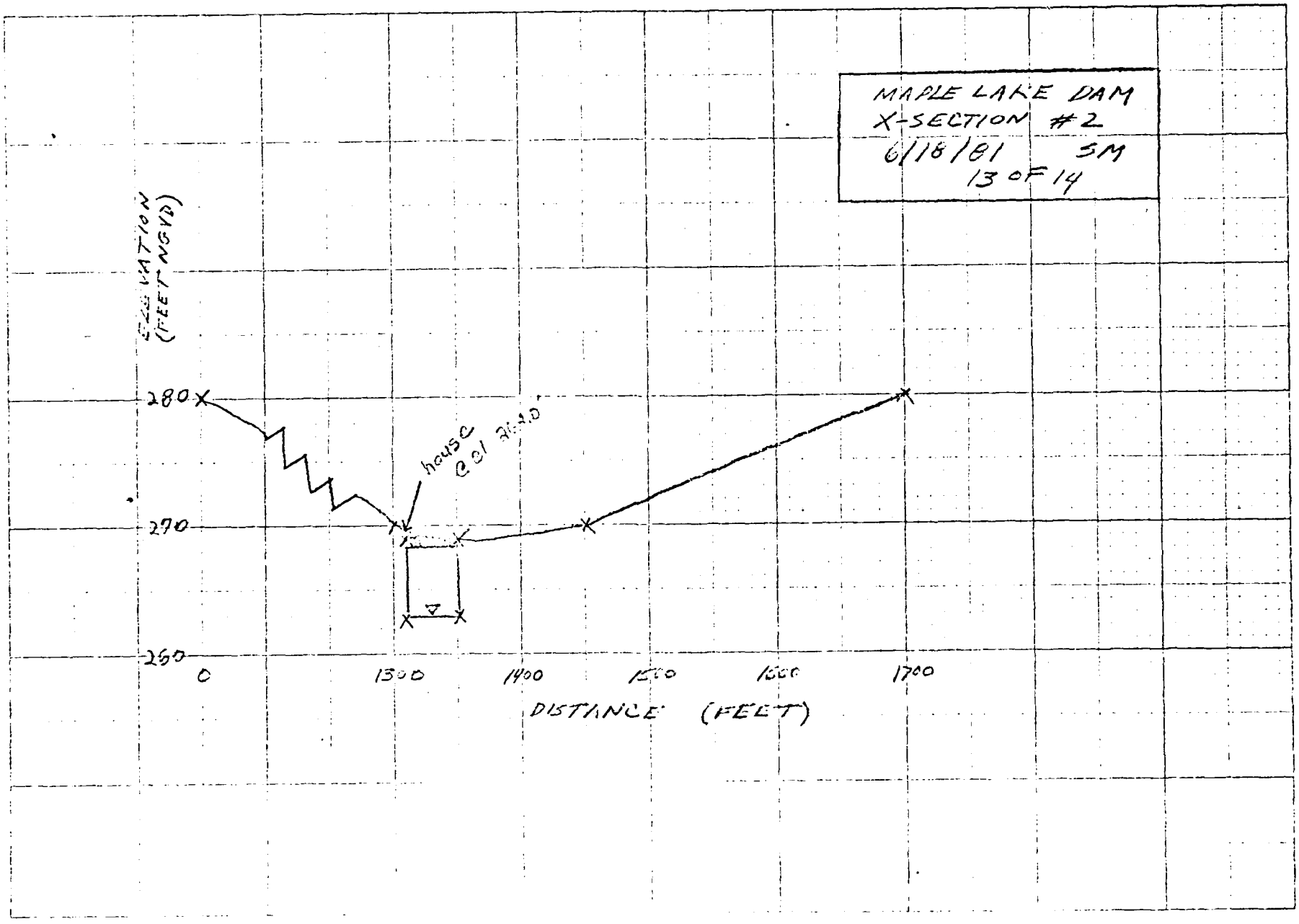
JOB NO.

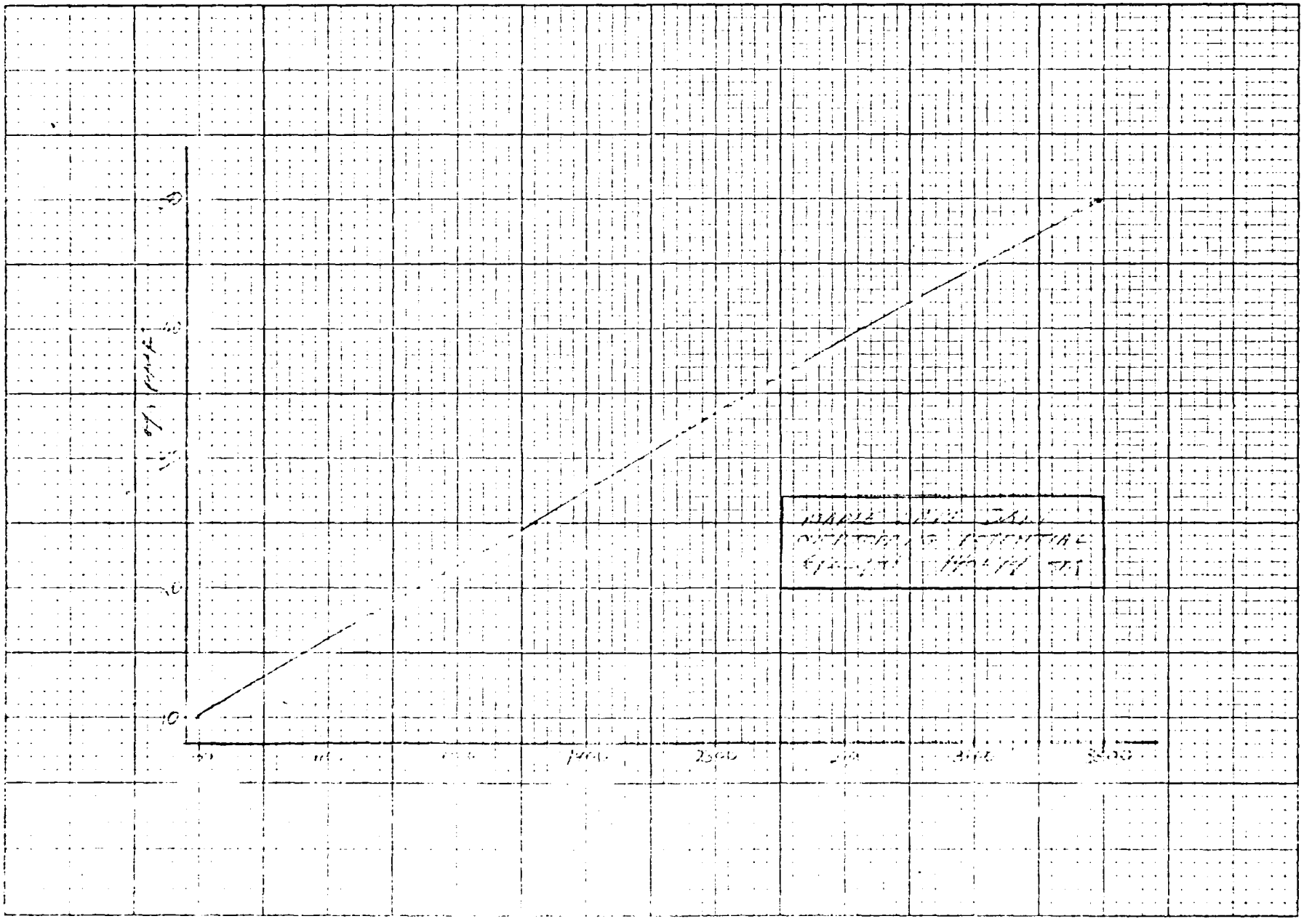
UARES IN. SCALE



CROSS SECTION
LOCATIONS
FOR D/S
HAZARD ANALYSIS




MAPLE LAKE DAM
X-SECTION #2
6/18/81 SM
13 OF 14
ELEVATION (FEET NGVD)
280
270
260
house
0
1500
1400
1700
DISTANCE (FEET)



APPENDIX 5

HEC-1 OUTPUT

MAPLE LAKE DAM

```
ID.......1.......2.......3.......4.......5.......6.......7.......8.......9......10

ID     MAPLE LAKE DAM  OVERTOPPING & BREACH   ANALYSIS  [illegible]  A-[illegible] INC.#
ID     NEW JERSEY DAM NO.776  BERGEN COUNTY  TOWNSHIP OF WYCKOFF
ID     0.1,0.25,0.5      MULTIPLES OF PMF FROM 24-HOUR PMP
IT         5                0     300
IO         2        1
JP         2        0
JK     FLOW       0.1     0.25      0.5

KK        A1     MAPLE  LAKE DAM
KM       SCS      UNIT GRAPH COMPUTATION   -EXPONENTIAL LOSS RATE
BA       2.2        0
BF       6.6      0.6        1
PM      22.0                          NO      113      123      132
LU         1       .1       10
UO       1.5

KK        A2   ROUTE INFLOW HYDROGRAPH THROUGH    MAPLE  LAKE
RS         1     STOR     30.4
SV         0     30.4     57.5       63       65     66.4      165    342.4
SE       274      285    287.9    288.3    289.8      290      295      300
SQ         0        0      407      711     1170     3625    10060    26713
SE       274      265      287    287.9    288.4    289.8      292      295
SS       255       48      3.0      1.5
ST     287.9      242      2.6      1.5
SQ       274       32        1       .1      300
KP         2
SB       274       32        1       .1    287.9

KK        A3    CHANNEL ROUTING-MOD PULS-AT SMALL DAM
KO         3
RS         1     STOR       -1
RC       .06     .045      .06      200      .01
RX         0      200      245      260      330      365      400      418
RY       290      280      275      272      272      275      280      290

KK        A4    CHANNEL ROUTING-MOD PULS-AT HOUSE AND NEWTON ROAD BRIDGE
RS         1     STOR       -1
RC       .06      .04      .06     1100     .008
RX         0     1300     1310     1310     1350     1350     1450     1700
RY       280      270      269      263      263      269      270      280
ZZ
```

```
*****************************************                    ****************************************
*                                       *                    *                                      *
*   FLOOD HYDROGRAPH PACKAGE   (HEC-1)  *                    *    U.S. ARMY CORPS OF ENGINEERS      *
*          FEBRUARY 1981                *                    *  THE HYDROLOGIC ENGINEERING CENTER   *
*                                       *                    *        609 SECOND STREET             *
*                                       *                    *      DAVIS, CALIFORNIA 95616         *
* RUN DATE07/30/81      TIME14.18.52    *                    *  (916) 440-3285 OR (FTS) 448-3285    *
*                                       *                    *                                      *
*****************************************                    ****************************************

                      MAPLE LAKE DAM  OVERTOPPING & BREACH   ANALYSIS  ##K3SOMERVILLE A-NGCO INC##
                      NEW JERSEY DAM NO.776  BERGEN COUNTY  TOWNSHIP OF WYCOFF
                      0.1.0.25.0.5     MULTIPLES OF PMF FROM 24-HOUR PMP

  5 IO         OUTPUT CONTROL VARIABLES
                    IPRNT          2  PRINT CONTROL
                    IPLOT         10  PLOT CONTROL
                    QSCAL         0.  HYDROGRAPH PLOT SCALE
                    OMSG         YES  PRINT DIAGNOSTIC MESSAGES

    IT         HYDROGRAPH TIME DATA
                     NMIN          5  MINUTES IN COMPUTATION INTERVAL
                    IDATE      1   0  STARTING DATE
                    ITIME       0000  STARTING TIME
                       NQ        300  NUMBER OF HYDROGRAPH ORDINATES
                   NDDATE      2   0  ENDING DATE
                   NDTIME       C055  ENDING TIME

                COMPUTATION INTERVAL    0.08 HOURS
                     TOTAL TIME BASE   24.92 HOURS

          ENGLISH UNITS
              DRAINAGE AREA          SQUARE MILES
              PRECIPITATION DEPTH    INCHES
              LENGTH, ELEVATION      FEET
              FLOW                   CUBIC FEET PER SECOND
              STORAGE VOLUME         ACRE-FEET
              SURFACE AREA           ACRES
              TEMPERATURE            DEGREES FAHRENHEIT

    JP         MULTI-PLAN OPTION
                    NPLAN          2  NUMBER OF PLANS

    JR         MULTI-RATIO OPTION
                  RATIOS OF RUNOFF
                 0.10      0.25      0.50

*** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** ***

          **************
  8 KK    *     A1     *         MAPLE  LAKE DAM
          **************
                        SCS    UNIT GRAPH COMPUTATION  -EXPONENTIAL LOSS RATE

             SUBBASIN RUNOFF DATA

 10 BA         SUBBASIN CHARACTERISTICS
                    TAREA       2.20  SUBBASIN AREA

 11 BF         BASE FLOW CHARACTERISTICS
                   STRTQ        6.60  INITIAL FLOW
                   QRCSN        6.60  BEGIN BASE FLOW RECESSION
                   RTIOR     1.00000  RECESSION CONSTANT

               PRECIPITATION DATA

 12 PM         PROBABLE MAXIMUM STORM
                     PMS       22.00  INDEX PRECIPITATION
                   TRSPC        0.80  TRANSPOSITION COEFFICIENT
                   TRSDA        2.20  TRANSPOSITION AREA
                     SWD          NO  USE SWD DISTRIBUTION
```

PERCENT OF INDEX PRECIPITATION OCCURRING IN GIVEN TIME

6-HR	12-HR	24-HR	48-HR	72-HR	96-HR
113.0	123.0	132.0	0.0	0.0	0.0

13 LU UNIFORM LOSS RATE

STRTL	1.00	INITIAL LOSS
CNSTL	0.10	UNIFORM LOSS RATE
RTIMP	10.00	PERCENT IMPERVIOUS AREA

14 UD SCS DIMENSIONLESS UNITGRAPH

TLAG	1.50	LAG

***

UNIT HYDROGRAPH
92 END-OF-PERIOD ORDINATES

11.	25.	51.	79.	113.	151.	196.	249.	309.	377.
448.	509.	567.	608.	646.	668.	684.	687.	687.	684.
665.	646.	620.	594.	564.	534.	497.	455.	413.	371.
334.	303.	277.	253.	231.	212.	193.	179.	166.	155.
139.	128.	117.	106.	97.	89.	82.	74.	69.	63.
56.	52.	48.	44.	40.	37.	34.	31.	28.	26.
24.	22.	20.	18.	17.	15.	14.	13.	12.	11.
10.	9.	8.	8.	7.	7.	6.	6.	5.	5.
4.	4.	4.	3.	3.	2.	2.	2.	1.	1.
1.	0.								

HYDROGRAPH AT STATION A1

DA	MON	HRMN	ORD	RAIN	LOSS	EXCESS	COMP Q	DA	MON	HRMN	ORD	RAIN	LOSS	EXCESS	COMP Q
1		0000	1	0.0	0.0	0.0	7.	1		1230	151	0.17	0.01	0.16	352.
1		0005	2	0.01	0.01	0.00	7.	1		1235	152	0.17	0.01	0.16	381.
1		0010	3	0.01	0.01	0.00	7.	1		1240	153	0.17	0.01	0.16	410.
1		0015	4	0.01	0.01	0.00	7.	1		1245	154	0.17	0.01	0.16	440.
1		0020	5	0.01	0.01	0.00	7.	1		1250	155	0.17	0.01	0.16	469.
1		0025	6	0.01	0.01	0.00	7.	1		1255	156	0.17	0.01	0.16	497.
1		0030	7	0.01	0.01	0.00	7.	1		1300	157	0.17	0.01	0.16	526.
1		0035	8	0.01	0.01	0.00	7.	1		1305	158	0.20	0.01	0.19	736.
1		0040	9	0.01	0.01	0.00	7.	1		1310	159	0.20	0.01	0.19	817.
1		0045	10	0.01	0.01	0.00	8.	1		1315	160	0.20	0.01	0.19	910.
1		0050	11	0.01	0.01	0.00	8.	1		1320	161	0.20	0.01	0.19	1007.
1		0055	12	0.01	0.01	0.00	8.	1		1325	162	0.20	0.01	0.19	1107.
1		0100	13	0.01	0.01	0.00	9.	1		1330	163	0.20	0.01	0.19	1210.
1		0105	14	0.01	0.01	0.00	9.	1		1335	164	0.20	0.01	0.19	1313.
1		0110	15	0.01	0.01	0.00	10.	1		1340	165	0.20	0.01	0.19	1418.
1		0115	16	0.01	0.01	0.00	10.	1		1345	166	0.20	0.01	0.19	1523.
1		0120	17	0.01	0.01	0.00	11.	1		1350	167	0.20	0.01	0.19	1627.
1		0125	18	0.01	0.01	0.00	12.	1		1355	168	0.20	0.01	0.19	1729.
1		0130	19	0.01	0.01	0.00	12.	1		1400	169	0.20	0.01	0.19	1830.
1		0135	20	0.01	0.01	0.00	13.	1		1405	170	0.25	0.01	0.24	1929.
1		0140	21	0.01	0.01	0.00	13.	1		1410	171	0.25	0.01	0.24	2026.
1		0145	22	0.01	0.01	0.00	14.	1		1415	172	0.25	0.01	0.24	2120.
1		0150	23	0.01	0.01	0.00	15.	1		1420	173	0.25	0.01	0.24	2211.
1		0155	24	0.01	0.01	0.00	15.	1		1425	174	0.25	0.01	0.24	2299.
1		0200	25	0.01	0.01	0.00	16.	1		1430	175	0.25	0.01	0.24	2381.
1		0205	26	0.01	0.01	0.00	16.	1		1435	176	0.25	0.01	0.24	2460.
1		0210	27	0.01	0.01	0.00	17.	1		1440	177	0.25	0.01	0.24	2535.
1		0215	28	0.01	0.01	0.00	17.	1		1445	178	0.25	0.01	0.24	2606.
1		0220	29	0.01	0.01	0.00	17.	1		1450	179	0.25	0.01	0.24	2671.
1		0225	30	0.01	0.01	0.00	16.	1		1455	180	0.25	0.01	0.24	2726.
1		0230	31	0.01	0.01	0.00	18.	1		1500	181	0.25	0.01	0.24	2741.

1	0815	100	0.02	0.01	0.02	77.	*	1	2045	250	0.01	0.01	0.01	769.
1	0820	101	0.02	0.01	0.02	86.	*	1	2050	251	0.01	0.01	0.01	704.
1	0825	102	0.02	0.01	0.02	95.	*	1	2055	252	0.01	0.01	0.01	654.
1	0830	103	0.02	0.01	0.02	105.	*	1	2100	253	0.01	0.01	0.01	608.
1	0835	104	0.02	0.01	0.02	116.	*	1	2105	254	0.01	0.01	0.01	564.
1	0840	105	0.02	0.01	0.02	126.	*	1	2110	255	0.01	0.01	0.01	526.
1	0845	106	0.02	0.01	0.02	136.	*	1	2115	256	0.01	0.01	0.01	490.
1	0850	107	0.02	0.01	0.02	146.	*	1	2120	257	0.01	0.01	0.01	457.
1	0855	108	0.02	0.01	0.02	157.	*	1	2125	258	0.01	0.01	0.01	427.
1	0900	109	0.02	0.01	0.02	167.	*	1	2130	259	0.01	0.01	0.01	399.
1	0905	110	0.02	0.01	0.02	176.	*	1	2135	260	0.01	0.01	0.01	374.
1	0910	111	0.02	0.01	0.02	186.	*	1	2140	261	0.01	0.01	0.01	351.
1	0915	112	0.02	0.01	0.02	195.	*	1	2145	262	0.01	0.01	0.01	331.
1	0920	113	0.02	0.01	0.02	203.	*	1	2150	263	0.01	0.01	0.01	312.
1	0925	114	0.02	0.01	0.02	211.	*	1	2155	264	0.01	0.01	0.01	294.
1	0930	115	0.02	0.01	0.02	218.	*	1	2200	265	0.01	0.01	0.01	278.
1	0935	116	0.02	0.01	0.02	225.	*	1	2205	266	0.01	0.01	0.01	263.
1	0940	117	0.02	0.01	0.02	231.	*	1	2210	267	0.01	0.01	0.01	249.
1	0945	118	0.02	0.01	0.02	237.	*	1	2215	268	0.01	0.01	0.01	236.
1	0950	119	0.02	0.01	0.02	242.	*	1	2220	269	0.01	0.01	0.01	224.
1	0955	120	0.02	0.01	0.02	246.	*	1	2225	270	0.01	0.01	0.01	213.
1	1000	121	0.02	0.01	0.02	250.	*	1	2230	271	0.01	0.01	0.01	203.
1	1005	122	0.02	0.01	0.02	254.	*	1	2235	272	0.01	0.01	0.01	194.
1	1010	123	0.02	0.01	0.02	258.	*	1	2240	273	0.01	0.01	0.01	185.
1	1015	124	0.02	0.01	0.02	261.	*	1	2245	274	0.01	0.01	0.01	177.
1	1020	125	0.02	0.01	0.02	264.	*	1	2250	275	0.01	0.01	0.01	170.
1	1025	126	0.02	0.01	0.02	266.	*	1	2255	276	0.01	0.01	0.01	163.
1	1030	127	0.02	0.01	0.02	269.	*	1	2300	277	0.01	0.01	0.01	156.
1	1035	128	0.02	0.01	0.02	271.	*	1	2305	278	0.01	0.01	0.01	150.
1	1040	129	0.02	0.01	0.02	273.	*	1	2310	279	0.01	0.01	0.01	145.
1	1045	130	0.02	0.01	0.02	275.	*	1	2315	280	0.01	0.01	0.01	141.
1	1050	131	0.02	0.01	0.02	277.	*	1	2320	281	0.01	0.01	0.01	137.
1	1055	132	0.02	0.01	0.02	278.	*	1	2325	282	0.01	0.01	0.01	133.
1	1100	133	0.02	0.01	0.02	280.	*	1	2330	283	0.01	0.01	0.01	131.
1	1105	134	0.02	0.01	0.02	281.	*	1	2335	284	0.01	0.01	0.01	128.
1	1110	135	0.02	0.01	0.02	282.	*	1	2340	285	0.01	0.01	0.01	125.
1	1115	136	0.02	0.01	0.02	283.	*	1	2345	286	0.01	0.01	0.01	123.
1	1120	137	0.02	0.01	0.02	285.	*	1	2350	287	0.01	0.01	0.01	121.
1	1125	138	0.02	0.01	0.02	286.	*	1	2355	288	0.01	0.01	0.01	119.
1	1130	139	0.02	0.01	0.02	286.	*	2	0000	289	0.0	0.0	0.0	118.
1	1135	140	0.02	0.01	0.02	287.	*	2	0005	290	0.0	0.0	0.0	116.
1	1140	141	0.02	0.01	0.02	288.	*	2	0010	291	0.0	0.0	0.0	114.
1	1145	142	0.02	0.01	0.02	288.	*	2	0015	292	0.0	0.0	0.0	112.
1	1150	143	0.02	0.01	0.02	289.	*	2	0020	293	0.0	0.0	0.0	111.
1	1155	144	0.02	0.01	0.02	290.	*	2	0025	294	0.0	0.0	0.0	109.
1	1200	145	0.02	0.01	0.02	290.	*	2	0030	295	0.0	0.0	0.0	107.
1	1205	146	0.17	0.01	0.16	292.	*	2	0035	296	0.0	0.0	0.0	104.
1	1210	147	0.17	0.01	0.16	296.	*	2	0040	297	0.0	0.0	0.0	102.
1	1215	148	0.17	0.01	0.16	304.	*	2	0045	298	0.0	0.0	0.0	99.
1	1220	149	0.17	0.01	0.16	315.	*	2	0050	299	0.0	0.0	0.0	96.
1	1225	150	0.17	0.01	0.16	331.	*	2	0055	300	0.0	0.0	0.0	92.
							*			SUM	23.22	2.40	20.82	

PEAK FLOW (CFS)	TIME (HR)		MAXIMUM AVERAGE FLOW 6-HR	24-HR	72-HR	24.92-HR
7009.	17.00	(CFS)	4189.	1234.	1189.	1189.
		(INCHES)	17.705	20.661	20.866	20.866
		(AC-FT)	2077.	2446.	2448.	2445.

CUMULATIVE AREA = 2.20 SQ MI

HYDROGRAPH AT STATION A1
PLAN 1, RATIO = 0.50

DA	MON	HRMN	ORD	FLOW	DA	MON	HRMN	ORD	FLOW	DA	MON	HRMN	ORD	FLOW	DA	MON	HRMN	ORD	FLOW
1		0000	1	3.	1		0615	76	11.	1		1230	151	176.	1		1845	226	1991.
1		0005	2	3.	1		0620	77	11.	1		1235	152	190.	1		1850	227	1912.
1		0010	3	3.	1		0625	78	11.	1		1240	153	208.	1		1855	228	1830.
1		0015	4	3.	1		0630	79	11.	1		1245	154	230.	1		1900	229	1745.
1		0020	5	3.	1		0635	80	11.	1		1250	155	257.	1		1905	230	1657.
1		0025	6	3.	1		0640	81	11.	1		1255	156	289.	1		1910	231	1569.
1		0030	7	3.	1		0645	82	12.	1		1300	157	325.	1		1915	232	1481.
1		0035	8	4.	1		0650	83	12.	1		1305	158	365.	1		1920	233	1395.
1		0040	9	4.	1		0655	84	12.	1		1310	159	408.	1		1925	234	1309.
1		0045	10	4.	1		0700	85	13.	1		1315	160	455.	1		1930	235	1226.
1		0050	11	4.	1		0705	86	13.	1		1320	161	503.	1		1935	236	1145.
1		0055	12	4.	1		0710	87	14.	1		1325	162	554.	1		1940	237	1066.
1		0100	13	4.	1		0715	88	14.	1		1330	163	605.	1		1945	238	990.
1		0105	14	5.	1		0720	89	15.	1		1335	164	657.	1		1950	239	918.
1		0110	15	5.	1		0725	90	16.	1		1340	165	709.	1		1955	240	849.
1		0115	16	5.	1		0730	91	16.	1		1345	166	762.	1		2000	241	784.
1		0120	17	6.	1		0735	92	16.	1		1350	167	813.	1		2005	242	723.
1		0125	18	6.	1		0740	93	19.	1		1355	168	865.	1		2010	243	665.
1		0130	19	6.	1		0745	94	21.	1		1400	169	915.	1		2015	244	612.
1		0135	20	6.	1		0750	95	22.	1		1405	170	965.	1		2020	245	563.
1		0140	21	7.	1		0755	96	25.	1		1410	171	1013.	1		2025	246	519.
1		0145	22	7.	1		0800	97	27.	1		1415	172	1060.	1		2030	247	479.
1		0150	23	7.	1		0805	98	31.	1		1420	173	1106.	1		2035	248	442.
1		0155	24	8.	1		0810	99	34.	1		1425	174	1149.	1		2040	249	410.
1		0200	25	8.	1		0815	100	38.	1		1430	175	1190.	1		2045	250	379.
1		0205	26	8.	1		0820	101	43.	1		1435	176	1230.	1		2050	251	352.
1		0210	27	8.	1		0825	102	48.	1		1440	177	1269.	1		2055	252	327.
1		0215	28	9.	1		0830	103	53.	1		1445	178	1307.	1		2100	253	304.
1		0220	29	9.	1		0835	104	58.	1		1450	179	1345.	1		2105	254	283.
1		0225	30	9.	1		0840	105	63.	1		1455	180	1383.	1		2110	255	263.
1		0230	31	9.	1		0845	106	68.	1		1500	181	1420.	1		2115	256	246.
1		0235	32	9.	1		0850	107	73.	1		1505	182	1457.	1		2120	257	229.
1		0240	33	9.	1		0855	108	78.	1		1510	183	1494.	1		2125	258	213.
1		0245	34	9.	1		0900	109	83.	1		1515	184	1531.	1		2130	259	200.
1		0250	35	10.	1		0905	110	88.	1		1520	185	1568.	1		2135	260	187.
1		0255	36	10.	1		0910	111	93.	1		1525	186	1608.	1		2140	261	176.
1		0300	37	10.	1		0915	112	97.	1		1530	187	1654.	1		2145	262	165.
1		0305	38	10.	1		0920	113	101.	1		1535	188	1712.	1		2150	263	156.
1		0310	39	10.	1		0925	114	105.	1		1540	189	1782.	1		2155	264	147.
1		0315	40	10.	1		0930	115	109.	1		1545	190	1867.	1		2200	265	139.
1		0320	41	10.	1		0935	116	113.	1		1550	191	1962.	1		2205	266	132.
1		0325	42	10.	1		0940	117	116.	1		1555	192	2069.	1		2210	267	125.
1		0330	43	10.	1		0945	118	118.	1		1600	193	2187.	1		2215	268	119.
1		0335	44	10.	1		0950	119	121.	1		1605	194	2318.	1		2220	269	112.
1		0340	45	10.	1		0955	120	123.	1		1610	195	2463.	1		2225	270	107.
1		0345	46	10.	1		1000	121	125.	1		1615	196	2619.	1		2230	271	102.
1		0350	47	10.	1		1005	122	127.	1		1620	197	2781.	1		2235	272	97.
1		0355	48	10.	1		1010	123	129.	1		1625	198	2940.	1		2240	273	93.
1		0400	49	10.	1		1015	124	130.	1		1630	199	3086.	1		2245	274	89.
1		0405	50	10.	1		1020	125	132.	1		1635	200	3214.	1		2250	275	85.
1		0410	51	11.	1		1025	126	133.	1		1640	201	3317.	1		2255	276	81.
1		0415	52	11.	1		1030	127	134.	1		1645	202	3399.	1		2300	277	78.
1		0420	53	11.	1		1035	128	136.	1		1650	203	3455.	1		2305	278	75.
1		0425	54	11.	1		1040	129	137.	1		1655	204	3490.	1		2310	279	72.
1		0430	55	11.	1		1045	130	138.	1		1700	205	3509.	1		2315	280	70.
1		0435	56	11.	1		1050	131	138.	1		1705	206	3504.	1		2320	281	68.
1		0440	57	11.	1		1055	132	139.	1		1710	207	3488.	1		2325	282	67.
1		0445	58	11.	1		1100	133	140.	1		1715	208	3450.	1		2330	283	65.
1		0450	59	11.	1		1105	134	141.	1		1720	209	3401.	1		2335	284	64.
1		0455	60	11.	1		1110	135	141.	1		1725	210	3341.	1		2340	285	63.
1		0500	61	11.	1		1115	136	142.	1		1730	211	3274.	1		2345	286	62.
1		0505	62	11.	1		1120	137	142.	1		1735	212	3198.	1		2350	287	61.
1		0510	63	11.	1		1125	138	143.	1		1740	213	3114.	1		2355	288	60.
1		0515	64	11.	1		1130	139	143.	1		1745	214	3021.	2		0000	289	59.
1		0520	65	11.	1		1135	140	144.	1		1750	215	2921.	2		0005	290	58.
1		0525	66	11.	1		1140	141	144.	1		1755	216	2815.	2		0010	291	57.
1		0530	67	11.	1		1145	142	144.	1		1800	217	2713.	2		0015	292	56.
1		0535	68	11.	1		1150	143	145.	1		1805	218	2616.	2		0020	293	55.
1		0540	69	11.	1		1155	144	145.	1		1810	219	2527.	2		0025	294	54.
1		0545	70	11.	1		1200	145	145.	1		1815	220	2444.	2		0030	295	53.
1		0550	71	11.	1		1205	146	146.	1		1820	221	2365.	2		0035	296	52.
1		0555	72	11.	1		1210	147	146.	1		1825	222	2288.	2		0040	297	51.
1		0000	73	11.	1		1215	148	152.	1		1830	223	2213.	2		0045	298	50.
1		0605	74	11.	1		1220	149	158.	1		1835	224	2139.	2		0050	299	48.
1		0610	75	11.	1		1225	150	166.	1		1840	225	2066.	2		0055	300	46.

PEAK FLOW (CFS)	TIME (HR)		MAXIMUM AVERAGE FLOW 6-HR	24-HR	72-HR	24.92-HR
3505.	17.00	(CFS)	2095.	617.	594.	594.
		(INCHES)	6.552	10.431	10.433	10.433
		(AC-FT)	1039.	1224.	1224.	1224.

CUMULATIVE AREA = 2.20 SQ MI

PLAN 2 INPUT DATA FOR STATION A1 ARE SAME AS FOR PLAN 1

15 KK A2 ROUTE INFLOW HYDROGRAPH THROUGH MAPLE LAKE

HYDROGRAPH ROUTING DATA

16 RS STORAGE ROUTING

NSTPS	1	NUMBER OF SUBREACHES
ITYP	STOR	TYPE OF INITIAL CONDITION
RSVRIC	38.40	INITIAL CONDITION
X	0.0	WORKING R AND D COEFFICIENT

17 SV	STORAGE	0.0	38.4	57.5	63.0	85.0	86.4	185.0	342.4
18 SE	ELEVATION	274.00	285.00	287.90	288.30	289.80	290.00	295.00	300.00
19 SQ	DISCHARGE	0.	0.	407.	711.	1170.	3625.	10060.	26713.
20 SE	ELEVATION	274.00	285.00	287.00	287.90	288.40	289.80	292.00	295.00

21 SS SPILLWAY

CREL	285.00	SPILLWAY CREST ELEVATION
SPWID	48.00	SPILLWAY WIDTH
COQW	3.00	WEIR COEFFICIENT
EXPW	1.50	EXPONENT OF HEAD

22 ST TOP OF DAM

TOPEL	297.90	ELEVATION AT TOP OF DAM
DAMWID	242.00	DAM WIDTH
COQD	2.60	WEIR COEFFICIENT
EXPD	1.50	EXPONENT OF HEAD

23 SB BREACH DATA

ELBM	274.00	ELEVATION AT BOTTOM OF BREACH
BRWID	32.00	WIDTH OF BREACH BOTTOM
Z	1.00	BREACH SIDE SLOPE
TFAIL	0.10	TIME FOR BREACH TO DEVELOP
FAILEL	300.00	W.S. ELEVATION TO TRIGGER FAILURE

***

COMPUTED STORAGE-OUTFLOW CURVE

STORAGE	0.0	38.40	51.57	57.50	64.46	85.00	125.84	185.00
OUTFLOW	0.0	0.0	407.00	711.00	1170.00	3625.00	10060.00	26713.00

HYDROGRAPH AT STATION A2
PLAN 1. RATIO = 0.50

DA	MON	HRMN	ORD	OUTFLOW	STORAGE	STAGE	DA	MON	HRMN	ORD	OUTFLOW	STORAGE	STAGE	DA	MON	HRMN	ORD	OUTFLOW	STORAGE	STAGE
1		0000	1	0.	38.4	285.0	1		0820	101	29.	39.3	285.1	1		1640	201	3233.	74.8	289.1
1		0005	2	1.	38.4	285.0	1		0825	102	32.	39.4	285.2	1		1645	202	3331.	75.3	289.1
1		0010	3	1.	38.4	285.0	1		0830	103	35.	39.5	285.2	1		1650	203	3407.	75.7	289.2
1		0015	4	1.	38.4	285.0	1		0835	104	39.	39.7	285.2	1		1655	204	3459.	76.0	289.2
1		0020	5	2.	38.5	285.0	1		0840	105	43.	39.8	285.2	1		1700	205	3490.	76.1	289.2
1		0025	6	2.	38.5	285.0	1		0845	106	47.	39.9	285.2	1		1705	206	3501.	76.2	289.2
1		0030	7	2.	38.5	285.0	1		0850	107	52.	40.1	285.3	1		1710	207	3496.	76.1	289.2
1		0035	8	3.	38.5	285.0	1		0855	108	56.	40.2	285.3	1		1715	208	3474.	76.0	289.2
1		0040	9	3.	38.5	285.0	1		0900	109	61.	40.4	285.3	1		1720	209	3435.	75.8	289.2
1		0045	10	3.	38.5	285.0	1		0905	110	66.	40.5	285.3	1		1725	210	3384.	75.6	289.2
1		0050	11	3.	38.5	285.0	1		0910	111	71.	40.7	285.3	1		1730	211	3323.	75.2	289.1
1		0055	12	3.	38.5	285.0	1		0915	112	75.	40.8	285.4	1		1735	212	3254.	74.8	289.1
1		0100	13	3.	38.5	285.0	1		0920	113	80.	41.0	285.4	1		1740	213	3176.	74.5	289.1
1		0105	14	4.	38.5	285.0	1		0925	114	84.	41.1	285.4	1		1745	214	3090.	74.0	289.1
1		0110	15	4.	38.5	285.0	1		0930	115	89.	41.3	285.4	1		1750	215	2996.	73.5	289.0
1		0115	16	4.	38.5	285.0	1		0935	116	93.	41.4	285.5	1		1755	216	2899.	73.0	289.0
1		0120	17	4.	38.5	285.0	1		0940	117	97.	41.5	285.5	1		1800	217	2799.	72.4	288.9
1		0125	18	5.	38.5	285.0	1		0945	118	101.	41.7	285.5	1		1805	218	2698.	71.9	288.9
1		0130	19	5.	38.6	285.0	1		0950	119	104.	41.8	285.5	1		1810	219	2599.	71.4	288.8
1		0135	20	5.	38.6	285.0	1		0955	120	108.	41.9	285.5	1		1815	220	2512.	70.9	288.8
1		0140	21	5.	38.6	285.0	1		1000	121	111.	42.0	285.5	1		1820	221	2439.	70.4	288.8
1		0145	22	6.	38.6	285.0	1		1005	122	114.	42.1	285.6	1		1825	222	2380.	70.0	288.8
1		0150	23	6.	38.6	285.0	1		1010	123	117.	42.2	285.6	1		1830	223	2334.	69.6	288.7
1		0155	24	6.	38.6	285.0	1		1015	124	119.	42.3	285.6	1		1835	224	2299.	69.2	288.7
1		0200	25	6.	38.6	285.0	1		1020	125	121.	42.3	285.6	1		1840	225	2276.	68.9	288.7
1		0205	26	7.	38.6	285.0	1		1025	126	123.	42.4	285.6	1		1845	226	2262.	68.3	288.7
1		0210	27	7.	38.6	285.0	1		1030	127	125.	42.5	285.6	1		1850	227	1976.	67.9	288.6
1		0215	28	7.	38.6	285.0	1		1035	128	127.	42.5	285.6	1		1855	228	1697.	67.4	288.6
1		0220	29	7.	38.6	285.0	1		1040	129	129.	42.6	285.6	1		1900	229	1419.	67.0	288.6
1		0225	30	8.	38.6	285.0	1		1045	130	130.	42.6	285.6	1		1905	230	1230.	66.5	288.5
1		0230	31	8.	38.7	285.0	1		1050	131	132.	42.7	285.6	1		1910	231	1043.	66.0	288.5
1		0235	32	8.	38.7	285.0	1		1055	132	133.	42.7	285.7	1		1915	232	1556.	65.4	288.5
1		0240	33	8.	38.7	285.0	1		1100	133	134.	42.7	285.7	1		1920	233	1470.	64.9	288.4
1		0245	34	8.	38.7	285.0	1		1105	134	135.	42.8	285.7	1		1925	234	1386.	64.4	288.4
1		0250	35	9.	38.7	285.0	1		1110	135	136.	42.8	285.7	1		1930	235	1302.	63.8	288.4
1		0255	36	9.	38.7	285.0	1		1115	136	137.	42.8	285.7	1		1935	236	1219.	63.1	288.3
1		0300	37	9.	38.7	285.0	1		1120	137	138.	42.9	285.7	1		1940	237	1171.	62.4	288.2
1		0305	38	9.	38.7	285.0	1		1125	138	139.	42.9	285.7	1		1945	238	1089.	61.7	288.2
1		0310	39	9.	38.7	285.0	1		1130	139	140.	42.9	285.7	1		1950	239	1021.	61.0	288.2
1		0315	40	9.	38.7	285.0	1		1135	140	140.	42.9	285.7	1		1955	240	951.	60.2	288.1
1		0320	41	9.	38.7	285.0	1		1140	141	141.	43.0	285.7	1		2000	241	885.	59.6	288.0
1		0325	42	10.	38.7	285.0	1		1145	142	142.	43.0	285.7	1		2005	242	822.	58.9	288.0
1		0330	43	10.	38.7	285.0	1		1150	143	142.	43.0	285.7	1		2010	243	764.	58.2	287.9
1		0335	44	10.	38.7	285.0	1		1155	144	143.	43.0	285.7	1		2015	244	711.	57.5	287.9
1		0340	45	10.	38.7	285.0	1		1200	145	143.	43.0	285.7	1		2020	245	679.	56.8	287.8
1		0345	46	10.	38.7	285.0	1		1205	146	143.	43.0	285.7	1		2025	246	634.	56.0	287.7
1		0350	47	10.	38.7	285.0	1		1210	147	144.	43.1	285.7	1		2030	247	593.	55.2	287.6
1		0355	48	10.	38.7	285.0	1		1215	148	145.	43.1	285.7	1		2035	248	553.	54.4	287.4
1		0400	49	10.	38.7	285.0	1		1220	149	147.	43.2	285.7	1		2040	249	515.	53.7	287.3
1		0405	50	10.	38.7	285.0	1		1225	150	150.	43.2	285.7	1		2045	250	479.	53.0	287.2
1		0410	51	10.	38.7	285.0	1		1230	151	154.	43.4	285.8	1		2050	251	445.	52.3	287.1
1		0415	52	10.	38.7	285.1	1		1235	152	159.	43.6	285.8	1		2055	252	413.	51.7	287.0
1		0420	53	10.	38.7	285.1	1		1240	153	167.	43.8	285.8	1		2100	253	382.	51.1	286.9
1		0425	54	10.	38.7	285.1	1		1245	154	177.	44.1	285.9	1		2105	254	373.	50.5	286.8
1		0430	55	10.	38.7	285.1	1		1250	155	190.	44.5	285.9	1		2110	255	356.	49.9	286.7
1		0435	56	10.	38.7	285.1	1		1255	156	206.	45.1	286.0	1		2115	256	345.	49.2	286.6
1		0440	57	10.	38.7	285.1	1		1300	157	229.	45.7	286.1	1		2120	257	316.	48.6	286.5
1		0445	58	10.	38.7	285.1	1		1305	158	248.	46.4	286.2	1		2125	258	298.	48.0	286.4
1		0450	59	10.	38.7	285.1	1		1310	159	275.	47.3	286.4	1		2130	259	280.	47.5	286.4
1		0455	60	10.	38.7	285.1	1		1315	160	305.	48.3	286.5	1		2135	260	263.	46.9	286.3
1		0500	61	10.	38.7	285.1	1		1320	161	339.	49.4	286.7	1		2140	261	248.	46.4	286.2
1		0505	62	10.	38.7	285.1	1		1325	162	375.	50.5	286.8	1		2145	262	233.	45.9	286.1
1		0510	63	10.	38.7	285.1	1		1330	163	415.	51.8	287.0	1		2150	263	219.	45.5	286.1
1		0515	64	10.	38.7	285.1	1		1335	164	462.	53.0	287.2	1		2155	264	206.	45.1	286.0

1	0615	64	10.	38.7	285.1	*	1	1335	164	482.	53.0	287.2	*	1	2155	264	206.	45.1	286.0
1	0620	65	10.	38.7	285.1	*	1	1340	165	542.	54.2	287.4	*	1	2200	265	194.	44.7	286.0
1	0625	66	10.	38.7	285.1	*	1	1345	166	600.	55.3	287.6	*	1	2205	266	182.	44.3	286.0
1	0630	67	10.	38.7	285.1	*	1	1350	167	656.	56.4	287.7	*	1	2210	267	172.	44.0	286.0
1	0635	68	10.	38.7	285.1	*	1	1355	168	711.	57.5	287.9	*	1	2215	268	162.	43.7	285.9
1	0640	69	10.	38.7	285.1	*	1	1400	169	787.	58.5	288.0	*	1	2220	269	153.	43.4	285.8
1	0645	70	11.	38.7	285.1	*	1	1405	170	858.	59.3	288.0	*	1	2225	270	145.	43.1	285.7
1	0650	71	11.	38.7	285.1	*	1	1410	171	922.	59.9	288.1	*	1	2230	271	137.	42.8	285.7
1	0655	72	11.	38.7	285.1	*	1	1415	172	980.	60.5	288.1	*	1	2235	272	130.	42.6	285.6
1	0700	73	11.	38.7	285.1	*	1	1420	173	1032.	61.1	288.2	*	1	2240	273	123.	42.4	285.6
1	0705	74	11.	38.7	285.1	*	1	1425	174	1082.	61.5	288.2	*	1	2245	274	117.	42.2	285.6
1	0710	75	11.	38.7	285.1	*	1	1430	175	1128.	62.0	288.2	*	1	2250	275	111.	42.0	285.5
1	0715	76	11.	38.7	285.1	*	1	1435	176	1172.	62.4	288.3	*	1	2255	276	106.	41.9	285.5
1	0720	77	11.	38.7	285.1	*	1	1440	177	1214.	62.8	288.3	*	1	2300	277	101.	41.7	285.5
1	0725	78	11.	38.7	285.1	*	1	1445	178	1254.	63.2	288.3	*	1	2305	278	96.	41.5	285.5
1	0730	79	11.	38.7	285.1	*	1	1450	179	1292.	63.5	288.3	*	1	2310	279	92.	41.4	285.5
1	0735	80	11.	38.7	285.1	*	1	1455	180	1330.	63.9	288.4	*	1	2315	280	88.	41.2	285.4
1	0740	81	11.	38.8	285.1	*	1	1500	181	1369.	64.2	288.4	*	1	2320	281	84.	41.1	285.4
1	0745	82	11.	38.8	285.1	*	1	1505	182	1411.	64.6	288.4	*	1	2325	282	81.	41.0	285.4
1	0750	83	11.	38.8	285.1	*	1	1510	183	1458.	64.9	288.4	*	1	2330	283	78.	40.9	285.4
1	0755	84	11.	38.8	285.1	*	1	1515	184	1498.	65.1	288.4	*	1	2335	284	75.	40.8	285.4
1	0700	85	12.	38.8	285.1	*	1	1520	185	1535.	65.3	288.5	*	1	2340	285	73.	40.8	285.4
1	0705	86	12.	38.8	285.1	*	1	1525	186	1574.	65.6	288.5	*	1	2345	286	71.	40.7	285.3
1	0710	87	12.	38.8	285.1	*	1	1530	187	1616.	65.8	288.5	*	1	2350	287	69.	40.6	285.3
1	0715	88	12.	38.8	285.1	*	1	1535	188	1665.	66.1	288.5	*	1	2355	288	67.	40.6	285.3
1	0720	89	13.	38.8	285.1	*	1	1540	189	1725.	66.4	288.5	*	2	0000	289	66.	40.5	285.3
1	0725	90	13.	38.8	285.1	*	1	1545	190	1799.	66.9	288.6	*	2	0005	290	64.	40.5	285.3
1	0730	91	14.	38.8	285.1	*	1	1550	191	1885.	67.4	288.6	*	2	0010	291	63.	40.4	285.3
1	0735	92	14.	38.9	285.1	*	1	1555	192	1983.	67.9	288.6	*	2	0015	292	62.	40.4	285.3
1	0740	93	15.	38.9	285.1	*	1	1600	193	2092.	68.6	288.7	*	2	0020	293	61.	40.4	285.3
1	0745	94	16.	38.9	285.1	*	1	1605	194	2214.	69.2	288.7	*	2	0025	294	59.	40.3	285.3
1	0750	95	17.	38.9	285.1	*	1	1610	195	2345.	70.0	288.8	*	2	0030	295	58.	40.3	285.3
1	0755	96	18.	39.0	285.1	*	1	1615	196	2496.	70.8	288.8	*	2	0035	296	57.	40.3	285.3
1	0800	97	20.	39.0	285.1	*	1	1620	197	2654.	71.7	288.9	*	2	0040	297	56.	40.2	285.3
1	0805	98	21.	39.1	285.1	*	1	1625	198	2814.	72.5	289.0	*	2	0045	298	55.	40.2	285.3
1	0810	99	24.	39.2	285.1	*	1	1630	199	2969.	73.4	289.0	*	2	0050	299	54.	40.1	285.3
1	0815	100	26.	39.2	285.1	*	1	1635	200	3110.	74.1	289.1	*	2	0055	300	52.	40.1	285.3

PEAK OUTFLOW IS 3501. AT TIME 17.08 HOURS

PEAK FLOW (CFS)	TIME (HR)		MAXIMUM AVERAGE FLOW 6-HR	24-HR	72-HR	24.92-HR
3501.	17.08	(CFS)	2092.	616.	593.	593.
		(INCHES)	8.639	10.414	10.415	10.415
		(AC-FT)	1037.	1222.	1222.	1222.

PEAK STORAGE (AC-FT)	TIME (HR)	MAXIMUM AVERAGE STORAGE 6-HR	24-HR	72-HR	24.92-HR
76.	17.08	68.	49.	46.	48.

PEAK STAGE (FEET)	TIME (HR)	MAXIMUM AVERAGE STAGE 6-HR	24-HR	72-HR	24.92-HR
289.20	17.08	288.64	286.33	286.29	286.29

CUMULATIVE AREA = 2.20 SQ MI

```
***     ***     ***     ***     ***     ***     ***     ***     ***     ***     ***     ***     ***     ***     ***     ***     ***

24 KP       PLAN  2 FOR STATION       A2           ROUTE INFLOW HYDROGRAPH THROUGH    MAPLE  LAKE

            HYDROGRAPH ROUTING DATA

16 KS         STORAGE ROUTING
                  NSTPS             1  NUMBER OF SUBREACHES
                   ITYP          STOR  TYPE OF INITIAL CONDITION
                 RSVRIC         38.40  INITIAL CONDITION
                      X           0.0  WORKING R AND D COEFFICIENT

17 SV          STORAGE        0.0      38.4      57.5      63.0      85.0      86.4     185.0     342.4

18 SE         ELEVATION    274.00    285.00    287.90    288.30    289.80    290.00    295.00    300.00

19 SQ         DISCHARGE        0.        0.      407.      711.     1170.     3625.    10060.    26713.

20 SE         ELEVATION    274.00    285.00    287.00    287.90    288.40    289.80    292.00    295.00

21 SS         SPILLWAY
                   CREL        285.00  SPILLWAY CREST ELEVATION
                  SPWID         46.00  SPILLWAY WIDTH
                   COQW          3.00  WEIR COEFFICIENT
                   EXPW          1.50  EXPONENT OF HEAD

22 ST         TOP OF DAM
                  TOPEL        287.90  ELEVATION AT TOP OF DAM
                 DAMWID        242.00  DAM WIDTH
                   COQD          2.50  WEIR COEFFICIENT
                   EXPD          1.50  EXPONENT OF HEAD

25 SB         BREACH DATA
                   ELBM        274.00  ELEVATION AT BOTTOM OF BREACH
                  BRWID         32.00  WIDTH OF BREACH BOTTOM
                      Z          1.00  BREACH SIDE SLOPE
                  TFAIL          0.10  TIME FOR BREACH TO DEVELOP
                 FAILEL        287.90  W.S. ELEVATION TO TRIGGER FAILURE

                                                       ***

                                     COMPUTED STORAGE-OUTFLOW CURVE
          STORAGE       0.0      38.40     51.57     57.50     64.46     85.00    125.84    185.00

          OUTFLOW       0.0        0.0    407.00    711.00   1170.00   3625.00  10060.00  26713.00
```

HYDROGRAPH AT STATION A2
PLAN 2. RATIO = 0.50

DA	MON	HRMN	ORD	OUTFLOW	STORAGE	STAGE	DA	MON	HRMN	ORD	OUTFLOW	STORAGE	STAGE	DA	MON	HRMN	ORD	OUTFLOW	STORAGE	STAGE
1		0000	1	0.	38.4	285.0	1		0820	101	29.	39.3	285.1	1		1640	201	3218.	31.2	282.9
1		0005	2	1.	38.4	285.0	1		0825	102	32.	39.4	285.2	1		1645	202	3319.	31.8	283.1
1		0010	3	1.	38.4	285.0	1		0830	103	35.	39.5	285.2	1		1650	203	3397.	32.2	283.2
1		0015	4	1.	38.4	285.0	1		0835	104	39.	39.7	285.2	1		1655	204	3441.	32.5	283.3
1		0020	5	2.	38.5	285.0	1		0840	105	43.	39.8	285.2	1		1700	205	3453.	32.7	283.4
1		0025	6	2.	38.5	285.0	1		0845	106	47.	39.9	285.2	1		1705	206	3446.	32.8	283.4
1		0030	7	2.	38.5	285.0	1		0850	107	52.	40.1	285.3	1		1710	207	3432.	32.8	283.4
1		0035	8	3.	38.5	285.0	1		0855	108	56.	40.2	285.3	1		1715	208	3421.	32.6	283.4
1		0040	9	3.	38.5	285.0	1		0900	109	61.	40.4	285.3	1		1720	209	3433.	32.4	283.3
1		0045	10	3.	38.5	285.0	1		0905	110	66.	40.5	285.3	1		1725	210	3383.	32.2	283.2
1		0050	11	3.	38.5	285.0	1		0910	111	71.	40.7	285.3	1		1730	211	3323.	31.8	283.1
1		0055	12	3.	38.5	285.0	1		0915	112	75.	40.8	285.4	1		1735	212	3256.	31.4	283.0
1		0100	13	3.	38.5	285.0	1		0920	113	80.	41.0	285.4	1		1740	213	3179.	31.0	282.9
1		0105	14	4.	38.5	285.0	1		0925	114	84.	41.1	285.4	1		1745	214	3094.	30.5	282.7
1		0110	15	4.	38.5	285.0	1		0930	115	89.	41.3	285.4	1		1750	215	3001.	29.9	282.6
1		0115	16	4.	38.5	285.0	1		0935	116	93.	41.4	285.5	1		1755	216	2901.	29.3	282.4
1		0120	17	4.	38.5	285.0	1		0940	117	97.	41.5	285.5	1		1800	217	2802.	28.7	282.2
1		0125	18	5.	38.5	285.0	1		0945	118	101.	41.7	285.5	1		1805	218	2703.	28.1	282.1
1		0130	19	5.	38.6	285.0	1		0950	119	104.	41.8	285.5	1		1810	219	2610.	27.5	281.9
1		0135	20	5.	38.6	285.0	1		0955	120	108.	41.9	285.5	1		1815	220	2522.	27.0	281.7
1		0140	21	5.	38.6	285.0	1		1000	121	111.	42.0	285.5	1		1820	221	2439.	26.4	281.6
1		0145	22	6.	38.6	285.0	1		1005	122	114.	42.1	285.6	1		1825	222	2361.	25.9	281.4
1		0150	23	6.	38.6	285.0	1		1010	123	117.	42.2	285.6	1		1830	223	2286.	25.4	281.3
1		0155	24	6.	38.6	285.0	1		1015	124	119.	42.3	285.6	1		1835	224	2212.	24.9	281.1
1		0200	25	6.	38.6	285.0	1		1020	125	121.	42.3	285.6	1		1840	225	2139.	24.4	281.0
1		0205	26	7.	38.6	285.0	1		1025	126	123.	42.4	285.6	1		1845	226	2064.	23.9	280.8

1		0210	27	7.	38.6	285.0	*	1	1030	127	125.	42.5	285.6	*	1	1850	227	1966.	23.4	280.7
1		0215	28	7.	38.6	285.0	*	1	1035	128	127.	42.5	285.6	*	1	1855	228	1910.	22.8	280.5
1		0220	29	7.	38.6	285.0	*	1	1040	129	129.	42.6	285.6	*	1	1900	229	1830.	22.2	280.4
1		0225	30	8.	38.6	285.0	*	1	1045	130	130.	42.6	285.6	*	1	1905	230	1747.	21.6	280.2
1		0230	31	8.	38.7	285.0	*	1	1050	131	132.	42.7	285.6	*	1	1910	231	1662.	20.9	280.0
1		0235	32	8.	38.7	285.0	*	1	1055	132	133.	42.7	285.7	*	1	1915	232	1576.	20.3	279.8
1		0240	33	8.	38.7	285.0	*	1	1100	133	134.	42.7	285.7	*	1	1920	233	1491.	19.6	279.6
1		0245	34	8.	38.7	285.0	*	1	1105	134	135.	42.8	285.7	*	1	1925	234	1408.	18.9	279.4
1		0250	35	9.	38.7	285.0	*	1	1110	135	136.	42.8	285.7	*	1	1930	235	1325.	18.2	279.2
1		0255	36	9.	38.7	285.0	*	1	1115	136	137.	42.8	285.7	*	1	1935	236	1244.	17.5	279.0
1		0300	37	9.	38.7	285.0	*	1	1120	137	138.	42.9	285.7	*	1	1940	237	1165.	16.8	278.8
1		0305	38	9.	38.7	285.0	*	1	1125	138	139.	42.9	285.7	*	1	1945	238	1089.	16.1	278.6
1		0310	39	9.	38.7	285.0	*	1	1130	139	140.	42.9	285.7	*	1	1950	239	1017.	15.4	278.4
1		0315	40	9.	38.7	285.0	*	1	1135	140	140.	42.9	285.7	*	1	1955	240	946.	14.8	278.2
1		0320	41	9.	38.7	285.0	*	1	1140	141	141.	43.0	285.7	*	1	2000	241	878.	14.1	278.0
1		0325	42	10.	38.7	285.0	*	1	1145	142	142.	43.0	285.7	*	1	2005	242	815.	13.4	277.8
1		0330	43	10.	38.7	285.0	*	1	1150	143	142.	43.0	285.7	*	1	2010	243	754.	12.8	277.7
1		0335	44	10.	38.7	285.0	*	1	1155	144	143.	43.0	285.7	*	1	2015	244	698.	12.2	277.5
1		0340	45	10.	38.7	285.0	*	1	1200	145	143.	43.0	285.7	*	1	2020	245	646.	11.6	277.3
1		0345	46	10.	38.7	285.0	*	1	1205	146	143.	43.0	285.7	*	1	2025	246	597.	11.0	277.2
1		0350	47	10.	38.7	285.0	*	1	1210	147	144.	43.1	285.7	*	1	2030	247	552.	10.5	277.0
1		0355	48	10.	38.7	285.0	*	1	1215	148	145.	43.1	285.7	*	1	2035	248	511.	10.0	276.9
1		0400	49	10.	38.7	285.0	*	1	1220	149	147.	43.2	285.7	*	1	2040	249	474.	9.5	276.7
1		0405	50	10.	38.7	285.0	*	1	1225	150	150.	43.2	285.7	*	1	2045	250	440.	9.1	276.6
1		0410	51	10.	38.7	285.0	*	1	1230	151	154.	43.4	285.8	*	1	2050	251	409.	8.7	276.5
1		0415	52	10.	38.7	285.1	*	1	1235	152	159.	43.6	285.8	*	1	2055	252	380.	8.3	276.4
1		0420	53	10.	38.7	285.1	*	1	1240	153	167.	43.8	285.8	*	1	2100	253	354.	7.9	276.3
1		0425	54	10.	38.7	285.1	*	1	1245	154	177.	44.1	285.9	*	1	2105	254	330.	7.5	276.2
1		0430	55	10.	38.7	285.1	*	1	1250	155	190.	44.5	285.9	*	1	2110	255	308.	7.2	276.1
1		0435	56	10.	38.7	285.1	*	1	1255	156	206.	45.1	286.0	*	1	2115	256	287.	6.9	276.0
1		0440	57	10.	38.7	285.1	*	1	1300	157	225.	45.7	286.1	*	1	2120	257	269.	6.6	275.9
1		0445	58	10.	38.7	285.1	*	1	1305	158	248.	46.4	286.2	*	1	2125	258	251.	6.3	275.8
1		0450	59	10.	38.7	285.1	*	1	1310	159	275.	47.3	286.4	*	1	2130	259	235.	6.1	275.7
1		0455	60	10.	38.7	285.1	*	1	1315	160	305.	48.3	286.5	*	1	2135	260	221.	5.8	275.7
1		0500	61	10.	38.7	285.1	*	1	1320	161	338.	49.4	286.7	*	1	2140	261	207.	5.6	275.6
1		0505	62	10.	38.7	285.1	*	1	1325	162	375.	50.5	286.8	*	1	2145	262	195.	5.4	275.5
1		0510	63	10.	38.7	285.1	*	1	1330	163	418.	51.8	287.0	*	1	2150	263	183.	5.1	275.5
1		0515	64	10.	38.7	285.1	*	1	1335	164	482.	53.0	287.2	*	1	2155	264	173.	5.0	275.4
1		0520	65	10.	38.7	285.1	*	1	1340	165	542.	54.2	287.4	*	1	2200	265	163.	4.8	275.4
1		0525	66	10.	38.7	285.1	*	1	1345	166	600.	55.3	287.6	*	1	2205	266	154.	4.6	275.3
1		0530	67	10.	38.7	285.1	*	1	1350	167	656.	56.4	287.7	*	1	2210	267	146.	4.4	275.3
1		0535	68	10.	38.7	285.1	*	1	1355	168	711.	57.5	287.9	*	1	2215	268	138.	4.3	275.2
1		0540	69	10.	38.7	285.1	*	1	1400	169	4139.	51.2	286.9	*	1	2220	269	131.	4.1	275.2
1		0545	70	11.	38.7	285.1	*	1	1405	170	2793.	28.7	282.2	*	1	2225	270	125.	4.0	275.1
1		0550	71	11.	38.7	285.1	*	1	1410	171	1662.	20.9	280.0	*	1	2230	271	118.	3.9	275.1
1		0555	72	11.	38.7	285.1	*	1	1415	172	1307.	18.0	279.2	*	1	2235	272	113.	3.7	274.1
1		0600	73	11.	38.7	285.1	*	1	1420	173	1195.	17.0	278.9	*	1	2240	273	108.	3.6	275.0
1		0605	74	11.	38.7	285.1	*	1	1425	174	1154.	16.7	278.8	*	1	2245	274	103.	3.5	275.0
1		0610	75	11.	38.7	285.1	*	1	1430	175	1163.	16.8	278.8	*	1	2250	275	98.	3.4	275.0
1		0615	76	11.	38.7	285.1	*	1	1435	176	1198.	17.0	278.9	*	1	2255	276	94.	3.3	275.0
1		0620	77	11.	38.7	285.1	*	1	1440	177	1222.	17.3	279.0	*	1	2300	277	89.	3.2	274.9
1		0625	78	11.	38.7	285.1	*	1	1445	178	1258.	17.6	279.1	*	1	2305	278	86.	3.1	274.9
1		0630	79	11.	38.7	285.1	*	1	1450	179	1296.	18.0	279.1	*	1	2310	279	83.	3.1	274.9
1		0635	80	11.	38.7	285.1	*	1	1455	180	1335.	18.3	279.2	*	1	2315	280	80.	3.0	274.9
1		0640	81	11.	38.8	285.1	*	1	1500	181	1372.	18.6	279.3	*	1	2320	281	77.	2.9	274.8
1		0645	82	11.	38.8	285.1	*	1	1505	182	1410.	18.9	279.4	*	1	2325	282	74.	2.9	274.8
1		0650	83	11.	38.8	285.1	*	1	1510	183	1447.	19.2	279.5	*	1	2330	283	71.	2.8	274.8
1		0655	84	11.	38.8	285.1	*	1	1515	184	1484.	19.5	279.6	*	1	2335	284	69.	2.7	274.8
1		0700	85	12.	38.8	285.1	*	1	1520	185	1522.	19.8	279.7	*	1	2340	285	68.	2.7	274.8
1		0705	86	12.	38.8	285.1	*	1	1525	186	1561.	20.1	279.8	*	1	2345	286	67.	2.7	274.8
1		0710	87	12.	38.8	285.1	*	1	1530	187	1602.	20.5	279.9	*	1	2350	287	65.	2.6	274.8
1		0715	88	12.	38.8	285.1	*	1	1535	188	1650.	20.8	280.0	*	1	2355	288	64.	2.6	274.7
1		0720	89	13.	38.8	285.1	*	1	1540	189	1709.	21.3	280.1	*	2	0000	289	63.	2.5	274.7
1		0725	90	13.	38.8	285.1	*	1	1545	190	1780.	21.8	280.3	*	2	0005	290	61.	2.5	274.7
1		0730	91	14.	38.9	285.1	*	1	1550	191	1864.	22.5	280.4	*	2	0010	291	60.	2.5	274.7
1		0735	92	14.	38.9	285.1	*	1	1555	192	1960.	23.2	280.6	*	2	0015	292	59.	2.4	274.7
1		0740	93	15.	38.9	285.1	*	1	1600	193	2069.	23.9	280.4	*	2	0020	293	57.	2.4	274.7
1		0745	94	16.	38.9	285.1	*	1	1605	194	2190.	24.8	281.1	*	2	0025	294	56.	2.4	274.7
1		0750	95	17.	38.9	285.1	*	1	1610	195	2324.	25.7	281.4	*	2	0030	295	55.	2.3	274.7

```
  1     0755  96      16.       39.0     265.1 *  1      1615 196     2473.      26.7    281.6 *  2      0035 296       54.        2.3     274.7
  1     0800  97      20.       39.0     265.1 *  1      1620 197     2631.      27.7    281.9 *  2      0040 297       52.        2.3     274.6
  1     0805  98      21.       39.1     265.1 *  1      1625 198     2791.      28.7    282.2 *  2      0045 298       51.        2.2     274.6
  1     0810  99      24.       39.2     265.1 *  1      1630 199     2949.      29.6    282.5 *  2      0050 299       50.        2.2     274.6
  1     0815 100      26.       39.2     265.1 *  1      1635 200     3093.      30.5    282.7 *  2      0055 300       49.        2.2     274.6
                                                 *                                              *
*********************************************************************************************************************************************

PEAK OUTFLOW IS      5563. AT TIME  14.02 HOURS

  PEAK FLOW      TIME                               MAXIMUM AVERAGE FLOW
   (CFS)         (HR)                       6-HR        24-HR       72-HR      24.92-HR
   4139.        14.00          (CFS)        2179.        634.        611.        611.
                            (INCHES)        9.209      10.725      10.727      10.727
                             (AC-FT)        1081.       1258.       1259.       1259.

 PEAK STORAGE    TIME                              MAXIMUM AVERAGE STORAGE
  (AC-FT)        (HR)                       6-HR        24-HR       72-HR      24.92-HR
     56.        13.94                        44.         31.         30.         30.

  PEAK STAGE     TIME                               MAXIMUM AVERAGE STAGE
   (FEET)        (HR)                       6-HR        24-HR       72-HR      24.92-HR
   267.91       13.94                     265.78      282.63      282.34      282.34

                          CUMULATIVE AREA =     2.20 SQ MI


*** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** ***

                 **************
                 *            *
  26 KK          *     43     *         CHANNEL ROUTING-MOD PULS-AT SMALL DAM
                 *            *
                 **************

  27 KO              OUTPUT CONTROL VARIABLES
                          IPRNT            3  PRINT CONTROL
                          IPLOT           10  PLOT CONTROL
                          QSCAL           0.  HYDROGRAPH PLOT SCALE

                   HYDROGRAPH ROUTING DATA

  28 RS              STORAGE ROUTING
                          NSTPS            1  NUMBER OF SUBREACHES
                           ITYP         STOR  TYPE OF INITIAL CONDITION
                         RSVRIC        -1.00  INITIAL CONDITION
                              X          0.0  WORKING R AND D COEFFICIENT

  29 RC              NORMAL DEPTH CHANNEL ROUTING
                            ANL        0.060  LEFT OVERBANK N-VALUE
                           ANCH        0.045  MAIN CHANNEL N-VALUE
                            ANR        0.060  RIGHT OVERBANK N-VALUE
                          RLNTH         200.  REACH LENGTH
                            SEL       0.0100  ENERGY SLOPE
                          ELMAX          0.0  MAX. ELEV. FOR STORAGE/OUTFLOW CALCULATION

                                                 CROSS-SECTION DATA
                              --- LEFT OVERBANK --- + ------ MAIN CHANNEL ------- + --- RIGHT OVERBANK ---
  31 RY          ELEVATION    290.00     280.00     275.00     272.00     272.00     275.00     280.00     290.00
  30 RX          DISTANCE        0.0     200.00     245.00     280.00     330.00     365.00     400.00     418.00

                                                         ***
```

COMPUTED STORAGE-OUTFLOW CURVE

STORAGE	0.0	0.27	0.63	1.08	1.63	2.24	2.91	3.66	4.46	5.34
	6.30	7.36	8.50	9.74	11.06	12.47	13.93	15.57	17.25	19.03
OUTFLOW	0.0	165.18	578.78	1253.40	2365.47	3825.00	5606.55	7722.46	10174.50	12956.50
	16110.69	19665.90	23634.62	28032.43	32874.40	38176.47	43954.45	50223.82	57000.07	64298.45
ELEVATION	272.00	272.95	273.89	274.84	275.79	276.74	277.68	278.63	279.58	280.53
	281.47	282.42	283.37	284.31	286.26	286.21	287.16	288.10	289.05	290.00

*** WARNING *** MODIFIED PULS ROUTING WILL BE NUMERICALLY UNSTABLE FOR OUTFLOWS BETWEEN 0. TO 64298.
USE SHORTER TIME INTERVAL OR LONGER REACH LENGTH

*** *** *** *** ***

HYDROGRAPH AT STATION A3
FOR PLAN 1, RATIO = 0.10

PEAK FLOW (CFS)	TIME (HR)		MAXIMUM AVERAGE FLOW 6-HR	24-HR	72-HR	24.92-HR
626.	17.33	(CFS)	415.	123.	119.	119.
		(INCHES)	1.754	2.081	2.081	2.081
		(AC-FT)	206.	244.	244.	244.

PEAK STORAGE (AC-FT)	TIME (HR)	MAXIMUM AVERAGE STORAGE 6-HR	24-HR	72-HR	24.92-HR
1.	17.25	0.	0.	0.	0.

PEAK STAGE (FEET)	TIME (HR)	MAXIMUM AVERAGE STAGE 6-HR	24-HR	72-HR	24.92-HR
274.64	17.25	273.49	272.48	272.46	272.46

CUMULATIVE AREA = 2.20 SQ MI

*** *** *** *** ***

HYDROGRAPH AT STATION A3
FOR PLAN 1, RATIO = 0.25

PEAK FLOW (CFS)	TIME (HR)		MAXIMUM AVERAGE FLOW 6-HR	24-HR	72-HR	24.92-HR
1749.	17.08	(CFS)	1042.	308.	297.	297.
		(INCHES)	4.402	5.205	5.206	5.206
		(AC-FT)	517.	611.	611.	611.

PEAK STORAGE (AC-FT)	TIME (HR)	MAXIMUM AVERAGE STORAGE 6-HR	24-HR	72-HR	24.92-HR
1.	17.08	1.	0.	0.	0.

PEAK STAGE (FEET)	TIME (HR)	MAXIMUM AVERAGE STAGE 6-HR	24-HR	72-HR	24.92-HR
275.76	17.08	274.47	272.65	272.62	272.82

CUMULATIVE AREA = 2.20 SQ MI

*** *** *** *** ***

HYDROGRAPH AT STATION A3
FOR PLAN 1, RATIO = 0.50

PEAK FLOW (CFS)	TIME (HR)		MAXIMUM AVERAGE FLOW 6-HR	24-HR	72-HR	24.92-HR
3500.	17.08	(CFS)	2092.	616.	593.	593.
		(INCHES)	8.840	10.413	10.415	10.415
		(AC-FT)	1037.	1222.	1222.	1222.

PEAK STORAGE (AC-FT)	TIME (HR)		6-HR	MAXIMUM AVERAGE STORAGE 24-HR	72-HR	24.92-HR
2.	17.08		1.	0.	0.	0.
PEAK STAGE (FEET)	TIME (HR)		6-HR	MAXIMUM AVERAGE STAGE 24-HR	72-HR	24.92-HR
276.53	17.08		275.47	273.27	273.22	273.22

CUMULATIVE AREA = 2.20 SQ MI

*** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** ***

PLAN 2 INPUT DATA FOR STATION A3 ARE SAME AS FOR PLAN 1

*** WARNING *** MODIFIED PULS ROUTING WILL BE NUMERICALLY UNSTABLE FOR OUTFLOWS BETWEEN 0. TO 64298.
USE SHORTER TIME INTERVAL OR LONGER REACH LENGTH

*** *** *** *** ***

HYDROGRAPH AT STATION A3
FOR PLAN 2. RATIO = 0.10

PEAK FLOW (CFS)	TIME (HR)		6-HR	MAXIMUM AVERAGE FLOW 24-HR	72-HR	24.92-HR
686.	17.33	(CFS)	415.	123.	119.	119.
		(INCHES)	1.754	2.081	2.081	2.081
		(AC-FT)	206.	244.	244.	244.
PEAK STORAGE (AC-FT)	TIME (HR)		6-HR	MAXIMUM AVERAGE STORAGE 24-HR	72-HR	24.92-HR
1.	17.25		0.	0.	0.	0.
PEAK STAGE (FEET)	TIME (HR)		6-HR	MAXIMUM AVERAGE STAGE 24-HR	72-HR	24.92-HR
274.04	17.25		273.49	272.48	272.46	272.46

CUMULATIVE AREA = 2.20 SQ MI

*** *** *** *** ***

HYDROGRAPH AT STATION A3
FOR PLAN 2. RATIO = 0.25

PEAK FLOW (CFS)	TIME (HR)		6-HR	MAXIMUM AVERAGE FLOW 24-HR	72-HR	24.92-HR
3651.	15.33	(CFS)	1128.	326.	314.	314.
		(INCHES)	4.768	5.518	5.519	5.519
		(AC-FT)	559.	647.	646.	648.
PEAK STORAGE (AC-FT)	TIME (HR)		6-HR	MAXIMUM AVERAGE STORAGE 24-HR	72-HR	24.92-HR
2.	15.33		1.	0.	0.	0.
PEAK STAGE (FEET)	TIME (HR)		6-HR	MAXIMUM AVERAGE STAGE 24-HR	72-HR	24.92-HR
276.82	15.33		274.55	272.86	272.83	272.83

CUMULATIVE AREA = 2.20 SQ MI

*** *** *** *** ***

*** *** *** ***

HYDROGRAPH AT STATION A3
FOR PLAN 2, RATIO = 0.50

PEAK FLOW (CFS)	TIME (HR)		6-HR	MAXIMUM AVERAGE FLOW 24-HR	72-HR	24.92-HR
3716.	14.00	(CFS)	2179.	634.	611.	611.
		(INCHES)	9.208	10.725	10.726	10.726
		(AC-FT)	1080.	1256.	1259.	1259.

PEAK STORAGE (AC-FT)	TIME (HR)		6-HR	MAXIMUM AVERAGE STORAGE 24-HR	72-HR	24.92-HR
2.	14.00		2.	0.	0.	0.

PEAK STAGE (FEET)	TIME (HR)		6-HR	MAXIMUM AVERAGE STAGE 24-HR	72-HR	24.92-HR
276.67	14.00		275.55	273.28	273.23	273.23

CUMULATIVE AREA = 2.20 SQ MI

*** ***

32 KK — A4 — CHANNEL ROUTING-MOD PULS-AT HOUSE AND NEWTON ROAD BRIDGE

HYDROGRAPH ROUTING DATA

33 RS — STORAGE ROUTING

NSTPS	1	NUMBER OF SUBREACHES
ITYP	STOR	TYPE OF INITIAL CONDITION
RSVRIC	-1.00	INITIAL CONDITION
X	0.0	WORKING R AND D COEFFICIENT

34 RC — NORMAL DEPTH CHANNEL ROUTING

ANL	0.060	LEFT OVERBANK N-VALUE
ANCH	0.040	MAIN CHANNEL N-VALUE
ANR	0.060	RIGHT OVERBANK N-VALUE
RLNTH	1100.	REACH LENGTH
SEL	0.0080	ENERGY SLOPE
ELMAX	0.0	MAX. ELEV. FOR STORAGE/OUTFLOW CALCULATION

CROSS-SECTION DATA

		--- LEFT OVERBANK ---		------ MAIN CHANNEL -------			--- RIGHT OVERBANK ---	
36 RY	ELEVATION	260.00	270.00	269.00	263.00	263.00	269.00	270.00	260.00
35 RX	DISTANCE	0.0	1300.00	1310.00	1310.00	1350.00	1350.00	1450.00	1700.00

***

COMPUTED STORAGE-OUTFLOW CURVE

STORAGE	0.0	0.90	1.81	2.71	3.61	4.52	5.42	6.42	9.10	14.60
	23.23	35.00	49.90	67.93	89.09	113.38	140.81	171.37	205.06	241.88
OUTFLOW	0.0	107.50	331.87	635.04	999.63	1414.40	1871.32	2362.23	3089.00	4210.69
	5941.01	8455.46	11910.64	16450.53	22209.74	29315.60	37889.49	48047.66	59902.84	73562.94
ELEVATION	263.00	263.59	264.79	265.68	266.58	267.47	268.37	269.26	270.16	271.05
	271.95	272.84	273.73	274.63	275.52	276.42	277.31	278.21	279.10	280.00

HYDROGRAPH AT STATION A4
PLAN 1. RATIO = 0.50

DA	MON	HRMN	ORD	OUTFLOW	STORAGE	STAGE	DA	MON	HRMN	ORD	OUTFLOW	STORAGE	STAGE	DA	MON	HRMN	ORD	OUTFLOW	STORAGE	STAGE
1		0000	1	0.	0.0	263.0	1		0420	101	25.	0.2	263.2	1		1640	201	3148.	9.4	270.2
1		0005	2	0.	0.0	263.0	1		0425	102	28.	0.2	263.2	1		1645	202	3234.	9.9	270.3
1		0010	3	0.	0.0	263.0	1		0430	103	31.	0.3	263.3	1		1650	203	3345.	10.4	270.4
1		0015	4	1.	0.0	263.0	1		0435	104	34.	0.3	263.3	1		1655	204	3415.	10.7	270.4
1		0020	5	1.	0.0	263.0	1		0440	105	38.	0.3	263.3	1		1700	205	3462.	10.9	270.5
1		0025	6	2.	0.0	263.0	1		0445	106	42.	0.3	263.3	1		1705	206	3489.	11.1	270.5
1		0030	7	2.	0.0	263.0	1		0450	107	46.	0.4	263.4	1		1710	207	3497.	11.1	270.5
1		0035	8	2.	0.0	263.0	1		0455	108	50.	0.4	263.4	1		1715	208	3478.	11.1	270.5
1		0040	9	2.	0.0	263.0	1		0500	109	54.	0.5	263.5	1		1720	209	3442.	10.9	270.5
1		0045	10	3.	0.0	263.0	1		0505	110	59.	0.5	263.5	1		1725	210	3421.	10.7	270.4
1		0050	11	3.	0.0	263.0	1		0910	111	64.	0.5	263.5	1		1730	211	3369.	10.5	270.4
1		0055	12	3.	0.0	263.0	1		0915	112	68.	0.6	263.6	1		1735	212	3306.	10.2	270.3
1		0100	13	3.	0.0	263.0	1		0920	113	73.	0.6	263.6	1		1740	213	3235.	9.8	270.3
1		0105	14	3.	0.0	263.0	1		0925	114	78.	0.7	263.6	1		1745	214	3155.	9.4	270.2
1		0110	15	4.	0.0	263.0	1		0930	115	82.	0.7	263.7	1		1750	215	3064.	9.0	270.1
1		0115	16	4.	0.0	263.0	1		0935	116	87.	0.7	263.7	1		1755	216	2957.	8.6	270.0
1		0120	17	4.	0.0	263.0	1		0940	117	91.	0.8	263.8	1		1800	217	2835.	8.2	269.9
1		0125	18	4.	0.0	263.0	1		0945	118	95.	0.8	263.8	1		1805	218	2704.	7.8	269.7
1		0130	19	4.	0.0	263.0	1		0950	119	99.	0.8	263.8	1		1810	219	2567.	7.5	269.6
1		0135	20	5.	0.0	263.0	1		0955	120	103.	0.9	263.9	1		1815	220	2565.	7.1	269.5
1		0140	21	5.	0.0	263.0	1		1000	121	106.	0.9	263.9	1		1820	221	2480.	6.8	269.4
1		0145	22	5.	0.0	263.0	1		1005	122	110.	0.9	263.9	1		1825	222	2399.	6.5	269.3
1		0150	23	5.	0.0	263.0	1		1010	123	114.	0.9	263.9	1		1830	223	2301.	6.3	269.1
1		0155	24	6.	0.0	263.0	1		1015	124	117.	0.9	263.9	1		1835	224	2226.	6.1	269.0
1		0200	25	6.	0.1	263.1	1		1020	125	119.	1.0	263.9	1		1840	225	2152.	5.9	268.9
1		0205	26	6.	0.1	263.1	1		1025	126	122.	1.0	264.0	1		1845	226	2079.	5.8	268.7
1		0210	27	7.	0.1	263.1	1		1030	127	124.	1.0	264.0	1		1850	227	2003.	5.7	268.6
1		0215	28	7.	0.1	263.1	1		1035	128	126.	1.0	264.0	1		1855	228	1925.	5.5	268.5
1		0220	29	7.	0.1	263.1	1		1040	129	128.	1.0	264.0	1		1900	229	1844.	5.4	268.3
1		0225	30	7.	0.1	263.1	1		1045	130	129.	1.0	264.0	1		1905	230	1761.	5.2	268.2
1		0230	31	8.	0.1	263.1	1		1050	131	131.	1.0	264.0	1		1910	231	1675.	5.0	268.0
1		0235	32	8.	0.1	263.1	1		1055	132	132.	1.0	264.0	1		1915	232	1588.	4.9	267.8
1		0240	33	8.	0.1	263.1	1		1100	133	133.	1.0	264.0	1		1920	233	1501.	4.7	267.6
1		0245	34	8.	0.1	263.1	1		1105	134	135.	1.0	264.0	1		1925	234	1416.	4.5	267.5
1		0250	35	8.	0.1	263.1	1		1110	135	136.	1.0	264.0	1		1930	235	1346.	4.4	267.3
1		0255	36	9.	0.1	263.1	1		1115	136	137.	1.0	264.0	1		1935	236	1276.	4.2	267.2
1		0300	37	9.	0.1	263.1	1		1120	137	138.	1.0	264.0	1		1940	237	1214.	4.1	267.0
1		0305	38	9.	0.1	263.1	1		1125	138	139.	1.0	264.0	1		1945	238	1127.	3.9	266.9
1		0310	39	9.	0.1	263.1	1		1130	139	139.	1.0	264.0	1		1950	239	1051.	3.7	266.7
1		0315	40	9.	0.1	263.1	1		1135	140	140.	1.0	264.0	1		1955	240	981.	3.6	266.5
1		0320	41	9.	0.1	263.1	1		1140	141	141.	1.0	264.0	1		2000	241	915.	3.4	266.4
1		0325	42	9.	0.1	263.1	1		1145	142	141.	1.0	264.0	1		2005	242	850.	3.2	266.2
1		0330	43	9.	0.1	263.1	1		1150	143	142.	1.0	264.0	1		2010	243	790.	3.1	266.1
1		0335	44	10.	0.1	263.1	1		1155	144	142.	1.0	264.0	1		2015	244	735.	3.0	265.9
1		0340	45	10.	0.1	263.1	1		1200	145	143.	1.0	264.0	1		2020	245	690.	2.8	265.7
1		0345	46	10.	0.1	263.1	1		1205	146	143.	1.0	264.0	1		2025	246	653.	2.6	265.7
1		0350	47	10.	0.1	263.1	1		1210	147	144.	1.0	264.0	1		2030	247	614.	2.5	265.6
1		0355	48	10.	0.1	263.1	1		1215	148	144.	1.1	264.0	1		2035	248	575.	2.5	265.5
1		0400	49	10.	0.1	263.1	1		1220	149	146.	1.1	264.0	1		2040	249	537.	2.4	265.4
1		0405	50	10.	0.1	263.1	1		1225	150	148.	1.1	264.1	1		2045	250	499.	2.3	265.3
1		0410	51	10.	0.1	263.1	1		1230	151	151.	1.1	264.1	1		2050	251	464.	2.2	265.2
1		0415	52	10.	0.1	263.1	1		1235	152	155.	1.1	264.1	1		2055	252	431.	2.1	265.1
1		0420	53	10.	0.1	263.1	1		1240	153	161.	1.1	264.1	1		2100	253	404.	2.0	265.0
1		0425	54	10.	0.1	263.1	1		1245	154	170.	1.2	264.1	1		2105	254	384.	2.0	264.9
1		0430	55	10.	0.1	263.1	1		1250	155	181.	1.2	264.2	1		2110	255	365.	1.9	264.9
1		0435	56	10.	0.1	263.1	1		1255	156	195.	1.3	264.2	1		2115	256	345.	1.8	264.8
1		0440	57	10.	0.1	263.1	1		1300	157	212.	1.3	264.3	1		2120	257	327.	1.8	264.8
1		0445	58	10.	0.1	263.1	1		1305	158	232.	1.4	264.4	1		2125	258	310.	1.7	264.7
1		0450	59	10.	0.1	263.1	1		1310	159	256.	1.5	264.5	1		2130	259	293.	1.6	264.6
1		0455	60	10.	0.1	263.1	1		1315	160	284.	1.6	264.6	1		2135	260	275.	1.6	264.5
1		0500	61	10.	0.1	263.1	1		1320	161	315.	1.7	264.7	1		2140	261	259.	1.5	264.5
1		0505	62	10.	0.1	263.1	1		1325	162	352.	1.9	264.8	1		2145	262	243.	1.5	264.4
1		0510	63	10.	0.1	263.1	1		1330	163	394.	2.0	265.0	1		2150	263	229.	1.4	264.4
1		0515	64	10.	0.1	263.1	1		1335	164	446.	2.1	265.1	1		2155	264	215.	1.3	264.3
1		0520	65	10.	0.1	263.1	1		1340	165	508.	2.3	265.3	1		2200	265	202.	1.3	264.3
1		0525	66	10.	0.1	263.1	1		1345	166	568.	2.5	265.5	1		2205	266	191.	1.2	264.2
1		0530	67	10.	0.1	263.1	1		1350	167	625.	2.7	265.7	1		2210	267	179.	1.2	264.2
1		0535	68	10.	0.1	263.1	1		1355	168	686.	2.8	265.8	1		2215	268	169.	1.2	264.1
1		0540	69	10.	0.1	263.1	1		1400	169	751.	3.0	266.0	1		2220	269	160.	1.1	264.1
1		0545	70	10.	0.1	263.1	1		1405	170	825.	3.2	266.2	1		2225	270	152.	1.1	264.1
1		0550	71	11.	0.1	263.1	1		1410	171	893.	3.4	266.3	1		2230	271	143.	1.0	264.0
1		0555	72	11.	0.1	263.1	1		1415	172	953.	3.5	266.5	1		2235	272	136.	1.0	264.0
1		0600	73	11.	0.1	263.1	1		1420	173	1009.	3.6	266.6	1		2240	273	129.	1.0	264.0

1	0600	73	11.	0.1	263.1	*	1	1420	173	1009.	3.6	266.6	*	1	2240	273	124.	1.0	264.0
1	0605	74	11.	0.1	263.1	*	1	1425	174	1062.	3.7	266.7	*	1	2245	274	122.	1.0	264.0
1	0610	75	11.	0.1	263.1	*	1	1430	175	1109.	3.9	266.8	*	1	2250	275	116.	0.9	263.9
1	0615	76	11.	0.1	263.1	*	1	1435	176	1154.	4.0	266.9	*	1	2255	276	110.	0.9	263.9
1	0620	77	11.	0.1	263.1	*	1	1440	177	1197.	4.0	267.0	*	1	2300	277	106.	0.9	263.9
1	0625	78	11.	0.1	263.1	*	1	1445	178	1237.	4.1	267.1	*	1	2305	278	102.	0.9	263.8
1	0630	79	11.	0.1	263.1	*	1	1450	179	1277.	4.2	267.2	*	1	2310	279	98.	0.8	263.8
1	0635	80	11.	0.1	263.1	*	1	1455	180	1316.	4.3	267.3	*	1	2315	280	94.	0.8	263.8
1	0640	81	11.	0.1	263.1	*	1	1500	181	1354.	4.4	267.3	*	1	2320	281	90.	0.8	263.7
1	0645	82	11.	0.1	263.1	*	1	1505	182	1395.	4.5	267.4	*	1	2325	282	86.	0.7	263.7
1	0650	83	11.	0.1	263.1	*	1	1510	183	1440.	4.6	267.5	*	1	2330	283	83.	0.7	263.7
1	0655	84	11.	0.1	263.1	*	1	1515	184	1484.	4.7	267.6	*	1	2335	284	80.	0.7	263.7
1	0700	85	11.	0.1	263.1	*	1	1520	185	1522.	4.7	267.7	*	1	2340	285	77.	0.6	263.6
1	0705	86	11.	0.1	263.1	*	1	1525	186	1560.	4.8	267.8	*	1	2345	286	74.	0.6	263.6
1	0710	87	12.	0.1	263.1	*	1	1530	187	1600.	4.9	267.8	*	1	2350	287	72.	0.6	263.6
1	0715	88	12.	0.1	263.1	*	1	1535	188	1647.	5.0	267.9	*	1	2355	288	70.	0.6	263.6
1	0720	89	12.	0.1	263.1	*	1	1540	189	1703.	5.1	268.0	*	2	0000	289	68.	0.6	263.6
1	0725	90	13.	0.1	263.1	*	1	1545	190	1771.	5.2	268.2	*	2	0005	290	67.	0.6	263.6
1	0730	91	13.	0.1	263.1	*	1	1550	191	1853.	5.4	268.3	*	2	0010	291	65.	0.5	263.5
1	0735	92	14.	0.1	263.1	*	1	1555	192	1947.	5.6	268.5	*	2	0015	292	64.	0.5	263.5
1	0740	93	14.	0.1	263.1	*	1	1600	193	2052.	5.8	268.7	*	2	0020	293	62.	0.5	263.5
1	0745	94	15.	0.1	263.1	*	1	1605	194	2170.	6.0	268.9	*	2	0025	294	61.	0.5	263.5
1	0750	95	16.	0.1	263.1	*	1	1610	195	2300.	6.3	269.1	*	2	0030	295	60.	0.5	263.5
1	0755	96	17.	0.1	263.1	*	1	1615	196	2429.	6.6	269.3	*	2	0035	296	59.	0.5	263.5
1	0800	97	18.	0.1	263.1	*	1	1620	197	2559.	7.1	269.5	*	2	0040	297	58.	0.5	263.5
1	0805	98	19.	0.2	263.2	*	1	1625	198	2716.	7.7	269.7	*	2	0045	298	57.	0.5	263.5
1	0810	99	21.	0.2	263.2	*	1	1630	199	2874.	8.3	269.9	*	2	0050	299	55.	0.5	263.5
1	0815	100	23.	0.2	263.2	*	1	1635	200	3023.	8.9	270.1	*	2	0055	300	54.	0.5	263.5

****

PEAK FLOW (CFS)	TIME (HR)		6-HR	MAXIMUM AVERAGE FLOW 24-HR	72-HR	24.92-HR
3497.	17.17	(CFS)	2092.	616.	593.	593.
		(INCHES)	8.639	10.410	10.411	10.411
		(AC-FT)	1037.	1221.	1222.	1222.

PEAK STORAGE (AC-FT)	TIME (HR)	6-HR	MAXIMUM AVERAGE STORAGE 24-HR	72-HR	24.92-HR
11.	17.17	6.	2.	2.	2.

PEAK STAGE (FEET)	TIME (HR)	6-HR	MAXIMUM AVERAGE STAGE 24-HR	72-HR	24.92-HR
270.46	17.17	268.53	264.92	264.85	264.85

CUMULATIVE AREA = 2.20 SQ MI

*** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** ***

PLAN 2 INPUT DATA FOR STATION A4 ARE SAME AS FOR PLAN 1

HYDROGRAPH AT STATION A4
PLAN 2. RATIO = 0.50

DA	MON	HRMN	GRD	OUTFLOW	STORAGE	STAGE	DA	MON	HRMN	GRD	OUTFLOW	STORAGE	STAGE	DA	MON	HRMN	GRD	OUTFLOW	STORAGE	STAGE
1		0000	1	0.	0.0	263.0	1		0820	101	25.	0.2	263.2	1		1640	201	3134.	9.3	270.2
1		0005	2	0.	0.0	263.0	1		0825	102	28.	0.2	263.2	1		1645	202	3240.	9.8	270.3
1		0010	3	0.	0.0	263.0	1		0830	103	31.	0.3	263.3	1		1650	203	3334.	10.3	270.4
1		0015	4	1.	0.0	263.0	1		0835	104	34.	0.3	263.3	1		1655	204	3405.	10.7	270.4
1		0020	5	1.	0.0	263.0	1		0840	105	38.	0.3	263.3	1		1700	205	3455.	10.9	270.4
1		0025	6	2.	0.0	263.0	1		0845	106	42.	0.3	263.3	1		1705	206	3483.	11.0	270.5
1		0030	7	2.	0.0	263.0	1		0850	107	46.	0.4	263.4	1		1710	207	3492.	11.1	270.5
1		0035	8	2.	0.0	263.0	1		0855	108	50.	0.4	263.4	1		1715	208	3484.	11.0	270.5
1		0040	9	2.	0.0	263.0	1		0900	109	54.	0.5	263.5	1		1720	209	3460.	10.9	270.5
1		0045	10	3.	0.0	263.0	1		0905	110	59.	0.5	263.5	1		1725	210	3420.	10.7	270.4
1		0050	11	3.	0.0	263.0	1		0910	111	64.	0.5	263.5	1		1730	211	3366.	10.5	270.4
1		0055	12	3.	0.0	263.0	1		0915	112	69.	0.6	263.6	1		1735	212	3297.	10.2	270.3
1		0100	13	3.	0.0	263.0	1		0920	113	73.	0.6	263.6	1		1740	213	3237.	9.9	270.3
1		0105	14	3.	0.0	263.0	1		0925	114	78.	0.7	263.6	1		1745	214	3156.	9.6	270.2
1		0110	15	4.	0.0	263.0	1		0930	115	82.	0.7	263.7	1		1750	215	3069.	9.0	270.1
1		0115	16	4.	0.0	263.0	1		0935	116	87.	0.7	263.7	1		1755	216	2982.	8.6	270.0
1		0120	17	4.	0.0	263.0	1		0940	117	91.	0.8	263.8	1		1800	217	2893.	8.2	269.9
1		0125	18	4.	0.0	263.0	1		0945	118	95.	0.8	263.8	1		1805	218	2803.	7.9	269.7
1		0130	19	4.	0.0	263.0	1		0950	119	99.	0.8	263.8	1		1810	219	2707.	7.5	269.5
1		0135	20	5.	0.0	263.0	1		0955	120	103.	0.9	263.9	1		1815	220	2576.	7.2	269.5
1		0140	21	5.	0.0	263.0	1		1000	121	106.	0.9	263.9	1		1820	221	2440.	6.8	269.4
1		0145	22	5.	0.0	263.0	1		1005	122	110.	0.9	263.9	1		1825	222	2409.	6.5	269.3
1		0150	23	5.	0.0	263.0	1		1010	123	114.	0.9	263.9	1		1930	223	2316.	6.3	269.1

1	0730	91	13.	0.1	263.1	*	1	1550	191	1834.	5.3	268.3	*	2	0010	291	62.	0.5	263.5
1	0735	92	14.	0.1	263.1	*	1	1555	192	1925.	5.5	268.5	*	2	0015	292	61.	0.5	263.5
1	0740	93	14.	0.1	263.1	*	1	1600	193	2029.	5.7	268.6	*	2	0020	293	59.	0.5	263.5
1	0745	94	15.	0.1	263.1	*	1	1605	194	2146.	6.0	268.9	*	2	0025	294	58.	0.5	263.5
1	0750	95	16.	0.1	263.1	*	1	1610	195	2276.	6.2	269.1	*	2	0030	295	57.	0.5	263.5
1	0755	96	17.	0.1	263.1	*	1	1615	196	2411.	6.5	269.3	*	2	0035	296	55.	0.5	263.5
1	0800	97	18.	0.1	263.1	*	1	1620	197	2536.	7.0	269.5	*	2	0040	297	54.	0.5	263.5
1	0805	98	19.	0.2	263.2	*	1	1625	198	2693.	7.6	269.7	*	2	0045	298	53.	0.4	263.4
1	0810	99	21.	0.2	263.2	*	1	1630	199	2853.	8.2	269.9	*	2	0050	299	52.	0.4	263.4
1	0815	100	23.	0.2	263.2	*	1	1635	200	3005.	8.8	270.0	*	2	0055	300	50.	0.4	263.4

PEAK FLOW (CFS)	TIME (HR)		MAXIMUM AVERAGE FLOW 6-HR	24-HR	72-HR	24.92-HR
3492.	17.17	(CFS)	2177.	634.	611.	611.
		(INCHES)	9.202	10.721	10.722	10.722
		(AC-FT)	1060.	1258.	1258.	1258.

PEAK STORAGE (AC-FT)	TIME (HR)	MAXIMUM AVERAGE STORAGE 6-HR	24-HR	72-HR	24.92-HR
11.	17.17	7.	2.	2.	2.

PEAK STAGE (FEET)	TIME (HR)	MAXIMUM AVERAGE STAGE 6-HR	24-HR	72-HR	24.92-HR
270.48	17.17	268.68	264.95	264.88	264.88

CUMULATIVE AREA = 2.20 SQ MI

PEAK FLOW AND STAGE (END-OF-PERIOD) SUMMARY FOR MULTIPLE PLAN-RATIO ECONOMIC COMPUTATIONS
FLOWS IN CUBIC FEET PER SECOND. AREA IN SQUARE MILES
TIME TO PEAK IN HOURS

OPERATION	STATION	AREA	PLAN		RATIOS APPLIED TO FLOWS RATIO 1 0.10	 RATIO 2 0.25	 RATIO 3 0.50
HYDROGRAPH AT	A1	2.20	1	FLOW	701.	1752.	3505.
				TIME	17.00	17.00	17.00
			2	FLOW	701.	1752.	3505.
				TIME	17.00	17.00	17.00
ROUTED TO	A2	2.20	1	FLOW	686.	1750.	3501.
				TIME	17.25	17.08	17.08
			2	FLOW	686.	4070.	4139.
				TIME	17.25	15.33	14.00
			** PEAK STAGES IN FEET **				
			1	STAGE	287.63	288.54	289.20
				TIME	17.25	17.08	17.08
			2	STAGE	287.63	287.90	287.91
				TIME	17.25	15.26	13.94
ROUTED TO	A3	2.20	1	FLOW	686.	1749.	3500.
				TIME	17.33	17.08	17.08
			2	FLOW	686.	3651.	3716.
				TIME	17.33	15.33	14.00
			** PEAK STAGES IN FEET **				
			1	STAGE	274.04	275.26	276.53
				TIME	17.25	17.08	17.08
			2	STAGE	274.04	276.62	276.67
				TIME	17.25	15.33	14.00
ROUTED TO	A4	2.20	1	FLOW	686.	1749.	3497.
				TIME	17.33	17.17	17.17
			2	FLOW	686.	3320.	3492.
				TIME	17.33	15.42	17.17
			** PEAK STAGES IN FEET **				
			1	STAGE	265.81	268.13	270.48
				TIME	17.33	17.17	17.17
			2	STAGE	265.81	270.34	270.48
				TIME	17.33	15.42	17.17

SUMMARY OF DAM OVERTOPPING/BREACH ANALYSIS FOR STATION A2

PLAN 1 .....

	INITIAL VALUE	SPILLWAY CREST	TOP OF DAM
ELEVATION	285.00	285.00	287.90
STORAGE	38.	38.	58.
OUTFLOW	0.	0.	711.

RATIO OF PMF	MAXIMUM RESERVOIR W.S.ELEV	MAXIMUM DEPTH OVER DAM	MAXIMUM STORAGE AC-FT	MAXIMUM OUTFLOW CFS	DURATION OVER TOP HOURS	TIME OF MAX OUTFLOW HOURS	TIME OF FAILURE HOURS
0.10	287.83	0.0	57.	686.	0.0	17.25	0.0
0.25	288.54	0.64	67.	1750.	4.25	17.08	0.0
0.50	289.20	1.30	76.	3501.	6.33	17.08	0.0

PLAN 2 .....

	INITIAL VALUE	SPILLWAY CREST	TOP OF DAM
ELEVATION	285.00	285.00	287.90
STORAGE	38.	38.	58.
OUTFLOW	0.	0.	711.

RATIO OF PMF	MAXIMUM RESERVOIR W.S.ELEV	MAXIMUM DEPTH OVER DAM	MAXIMUM STORAGE AC-FT	MAXIMUM OUTFLOW CFS	DURATION OVER TOP HOURS	TIME OF MAX OUTFLOW HOURS	TIME OF FAILURE HOURS
0.10	287.83	0.0	57.	686.	0.0	17.25	0.0
0.25	287.90	0.00	58.	5469.	0.11	15.35	15.25
0.50	287.91	0.01	58.	5563.	0.03	14.02	13.92

*** NORMAL END OF JOB ***

AD-A103 935 NEW JERSEY DEPT OF ENVIRONMENTAL PROTECTION TRENTON --ETC F/G 13/13
NATIONAL DAM SAFETY PROGRAM. MAPLE LAKE DAM (NJ 00776), PASSAIC--ETC(U)
JUL 81 W GUINAN DACW61-79-C-0011

UNCLASSIFIED DAEN/NAP-53842/NJ00776-81/ NL

APPENDIX 6

REFERENCES

MAPLE LAKE DAM

APPENDIX 6
REFERENCES

MAPLE LAKE DAM

Chow, Ven Te, Open Channel Hydraulics, McGraw Hill Book Company, New York, 1959.

King, H.W. and E.F. Brater, Handbook of Hydraulics, McGraw Hill Book Company, New York, Fifth Edition 1963.

Lewis, J.V. and H.B. Kummel (1910-1912) Geologic Map of New Jersey, revised by H.B. Kummel, 1931, and by M.E. Johnson, 1950. New Jersey Department of Conservation of Economic Development Atlas.

Salisbury, Kummel, Peet and Whitson, (1902) Glacial Map of New Jersey.

Schway, G.O., R.K. Frevert, T.W. Edmister, and K.K. Barnes, Soil and Water Conservation Engineering, The Ferguson Foundation Agricultural Engineering Series, John Wiley and Sons, Inc., New York, 1966, 683 pp.

U.S. Army Corps of Engineers, Hydrologic Engineering Center, Flood Hydrograph Package (HEC-1) Users Manual-Preliminary, Davis, California, March 1981.

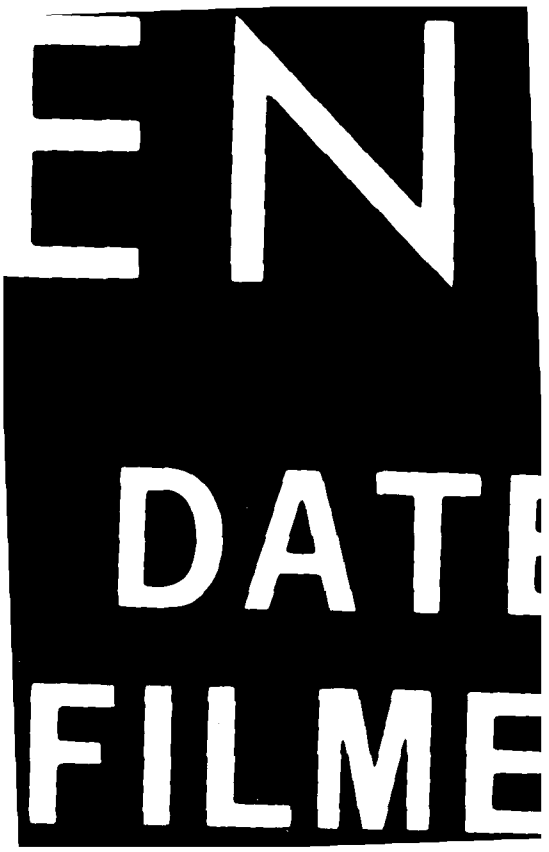
U.S. Department of Agriculture, Soil Conservation Service, Urban Hydrology for Small Watersheds, Technical Release No. 55, Washington, 1975.

U.S. Department of Commerce, Weather Bureau, "Seasonal Variation of the Probable Maximum Precipitation East of the 105th Meridian for Areas from 10 to 1000 Square Miles and Durations of 6, 12, 24, and 48 Hours", Hydrometeorological Report No. 33, Washington, 1977, 816 pp.

United States Department of Interior, Bureau of Reclamation, Design of Small Dams, U.S. Government Printing Office, Washington, 1977, 816 pp.

U.S. Department of Interior, Geological Survey, 7.5-Minute Series (topographic) maps, scale 1:24000, Contour Interval 10 feet: Paterson, New Jersey, (1955), Photorevised 1970.

Viessman, Warren, Jr., J.W. Knapp, G.L. Lewis, T.E. Harbaugh, Introduction to Hydrology, Harper and Row, Publishers, New York, Second Edition 1977, 704 pp.


EN
DATE
FILME